This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

From the
Fine Arts Library
Fogg Art Museum
Harvard University

THE
GELATINO-CHLORIDE OF SILVER
PRINTING-OUT PROCESS.

23,270 46/4

THE

GELATINO-CHLORIDE OF SILVER PRINTING-OUT PROCESS,

INCLUDING

DIRECTIONS FOR THE PRODUCTION OF THE SENSITIVE PAPER.

BY

WALTER E. WOODBURY.

London:
HAZELL, WATSON, & VINEY, Ld.,
1, CREED LANE, E.C.
1891.

SEP '97
FAS fund
ncir

PATENT OFFICE LIBRARY
SRIS STOCK

Printed by Hazell, Watson, & Viney, Ld., London and Aylesbury.

PATENT OFFICE LIBRARY
DELETED FROM SRIS STOCK

PREFACE.

12·5·93

SINCE the reintroduction of gelatino-chloride of silver printing into this country many queries have appeared in the columns of the *Amateur Photographer* from distracted correspondents regarding the treatment of the paper, and their own inability to succeed with it. This fact led me to think that a book, written expressly upon the subject, and treating fully upon the necessary manipulations, would come as a boon and a blessing to many amateurs. The result is the present work; and that it will fulfil its object, to relieve many in difficulties, and help to raise this beautiful printing process in the estimation of all, is the earnest wish of the writer.

I have also added some instructions as to the manufacture of the sensitive paper. To the study of this I have given much attention, and devoted much time in experimenting. I only hope that the reader will succeed as well as I have done myself, which there is no reason to believe that he should not.

It may be mentioned that the title "Gelatino-Chloride Printing-out Process" is given to the work in contradistinction to the other methods of gelatino-chloride printing by development of an entirely different nature.

WALTER E. WOODBURY.

DELETED FROM
SRIS STOCK

PATENT OFFICE
LIBRARY

CONTENTS.

PART I.

TREATMENT OF THE PREPARED PAPER

CHAP. PAGE
I. INTRODUCTION 1
II. TREATMENT OF THE PAPER AND THE NEGATIVE . 4
III. PRINTING MANIPULATIONS 8
IV. WASHING THE PRINTS 12
V. GENERAL REMARKS ON GOLD TONING . . . 14
VI. GOLD-TONING FORMULÆ 17
VII. TONING AND FIXING OPERATIONS 23
VIII. COMBINED TONING AND FIXING BATHS . . . 28
IX. PLATINUM AND URANIUM TONING 36
X. WASHING THE PRINTS 40
XI. TANNING AND HARDENING THE PRINTS . . . 42
XII. ENAMELLING THE PRINTS 44

CHAP. PAGE
XIII. TRIMMING AND MOUNTING 49
XIV. FAILURES 58
XV. PERMANENCY 66

PART II.

PREPARATION OF THE SENSITISED PAPER.

I. INTRODUCTION 69
II. CHOICE OF PAPER 71
III. PREPARATION OF THE EMULSION 73
IV. COATING THE PAPER 81
V. DRYING THE PAPER 84
VI. FAILURES 86

APPENDIX.

PRINTING OUT PAPERS.

ARISTOTYPE 91
CELEROTYPE 107
OBERNETTER 112

PATENT OFFICE LIBRARY

PART I.

TREATMENT OF THE PREPARED PAPER.

12-5-93

CHAPTER I.

INTRODUCTION.

IN the chain of photographic discoveries many proofs are given of the old saying that history repeats itself. When photography was in its infancy paper was used for the support of the sensitive compound to form the negative. This was afterwards replaced by glass. A few years ago the advantages of returning to paper as the support were pointed out, and the matter was taken up again. Another instance may be taken in gelatino or collodio-chloride of silver for positive printing. As early as 1865 G. Wharton Simpson devised a process of silver printing in which the sensitive salts were held in suspension by collodion, and the process was called

Simpson-type. For some reason or other, never clearly explained, this beautiful and superior process died out in favour of the albumenised paper method. I call it superior advisedly; and the reader can judge for himself by referring to back numbers of both English and foreign photographic journals, where it will be seen that in many cases the prints on such paper were better than those on albumen paper, and moreover, they are in a far better state of preservation than the albumen prints made at the same time.

In the year 1882 Abney suggested a "chloro-citrate" or "citro-chloride" emulsion, which contained chloride of silver and citrate of silver emulsified in gelatine. Although Obernetter and others had worked the collodio-chloride process from Wharton Simpson's first discovery, this was the first mention of a gelatino-chloride printing paper. In 1885 the late J. B. Obernetter of Munich introduced commercially a gelatine emulsion paper, and was followed the next year by Liesegang of Düsseldorf and Trapp and Münch of Berlin, the latter of whom worked from a formula which was the result of the experiments of Dr. Stolze. In 1885 Messrs. Ashman and Offord published in the *Photographic News* a valuable series of experiments, and these papers are the only complete monograph upon the manufacture of the emulsion which has been made public. They are, however, of far greater interest to the maker than to the user of such paper.

It was not, however, till the year 1890 that the manufacture of gelatino-chloride papers was taken up commercially in England. Large quantities are now produced under the name of "Celerotype."

Briefly, the gelatino-chloride emulsion paper may be described as a paper coated with an insoluble film of gelatine and pigment, which may be either sulphate of barytes, chalk, or any suitable substance, the purpose of this film being to prevent the subsequent coating of emulsion of sensitive silver salts from sinking into the pores of the paper, and thus forming a white or coloured impermeable support for the film of sensitive emulsion.

The paper coated with emulsion, either by hand or by suitable machinery, is cut into sheets or into different sizes, packed, and placed on the market.

Our object is to describe now the correct manipulation of the paper from the time it is received from the dealer's hands up to its transformation into the mounted and finished print. In Part II. will be found directions for making the sensitive paper, though perhaps it will be as well to at once point out that, like the manufacture of dry plates, it is extremely doubtful if there are any advantages to be gained by those amateurs who consume a small quire of paper; but to those who make large numbers of large-sized pictures it would perhaps be a considerable saving to them when once the preliminary difficulties were mastered.

PATENT OFFICE LIBRARY

CHAPTER II.

TREATMENT OF THE PAPER AND THE NEGATIVE.

I HAVE already stated that this paper is obtained in sheets or in cut sizes. If purchased in the latter form some little time and trouble are saved; but of course, if prints of various sizes are required, it will be necessary to purchase the sensitised paper in sheets. This paper will keep for a few months if kept free from light and moisture. If kept under pressure in a letter press or under a heavy weight it will keep for a still longer period.

CUTTING THE PAPER.

Always remember that the sensitised paper is very easily stained by coming into contact with any foreign matter. Before laying it down anywhere it should be noted that the place is quite clean. Handling the sensitised surface should be avoided as much as possible.

The paper may be folded to the required sizes and cut with an ivory or wood paper knife, or clean steel knife.

The paper should be cut to the exact size of the negative, thus leaving a small margin for trimming the print more accurately.

THE NEGATIVE.

Amateurs' negatives are not, as a rule, perfect, and therefore a little consideration with regard to the treatment of the different kinds of negatives, to obtain the best results upon gelatino-chloride paper, must be given. The usual idea of many amateurs with regard to printing is to place the paper and negative in a frame together, and wait till it is "done." This is, however, decidedly erroneous. Before any print is taken a careful study of the negative should be made, and the best treatment decided upon.

In the instructions as to the manufacture of the sensitised paper a method is given of altering the quality of the emulsion by regulating the amount of silver nitrate so as to suit the class of negatives that are to be printed from. But those who obtain their paper commercially are obliged to use the same to any class of negative. We have then to study the different ways of treatment in the printing. With a thin negative printing should be conducted in a weak light, or a piece of clean tissue paper pasted over the printing frame to subdue the light. One of the principal advantages of the chloride emulsion paper is its ability to give good prints from weak negatives—superior, in fact, to any that could be obtained by other printing-out processes. Very weak negatives can further be made to yield good results by printing under green glass. This is explained by the fact that the emulsion film contains two principal compounds, silver chloride and silver citrate, these two being sensitive to light, but in different degrees. The action of the light upon chloride of silver is almost entirely confined to the ultra-violet rays, while the citrate of silver is altered by the blue rays and some distance into the green, which have hardly any effect upon the silver chloride. Now the chloride of silver gives more gradation than the citrate, so that, if we place the green glass over the negative, we prevent to a certain extent the action of the light upon the silver chloride, and confine it almost entirely to the silver citrate, which gives much greater contrasts. Hence, from a weak negative we are able to obtain good pictures full of vigour.

With regard to the printing of intense negatives with strong high lights, and wanting in detail, much more difficulty will be experienced in obtaining satisfactory prints from them. In contrast to the method adopted in printing from a weak negative, it is necessary to print as rapidly as possible, and place the printing frame exposed to the direct rays of the sun. The blank whites without detail may often be softened down and improved by exposing the paper, after removing from the negative, for a few seconds in the light. Even then, however, the results are inferior to those obtained on ordinary albumenised paper.

Accidents will happen; and it is now and then necessary to print from a broken negative. If the glass is merely cracked or broken across, and the film itself uninjured, the matter is a simple one, and is described later on, no special preparation being necessary. If, however, the negative is broken into small pieces, they must be carefully put together, and a piece of paper, coated with glue, stuck firmly on to the glass side, the edges overlapping. The whole is then carefully turned over, and the overlapping edges rubbed down on to the film side without allowing it to occupy any portion required in the print. When the paper dries it contracts very considerably, and draws the pieces tightly together. The paper may then be rendered semi-transparent with vaseline or castor-oil. The best method of printing from broken or cracked negatives is to suspend them from a roasting jack or other arrangement which will allow of their being constantly revolved.

PATENT OFFICE LIBRARY

CHAPTER III.

PRINTING MANIPULATIONS.

IN the operation of printing from the negative much thought and care should be devoted. By the finished print so do we gauge the amateur's photographic abilities. What is the use, then, of the care and consideration given to the making of the negative if the prints from it are carelessly made? There are many amateurs now who can turn out faultless negatives which are only seen by themselves and their brother-amateurs, but who cannot show a respectable print, owing to the little attention given to the art of printing.

PLACING IN THE FRAMES.

The placing of the negative and the paper in the printing frame is the first operation, and seems a simple one; but it is an easy thing to break negatives. If the slightest piece of dirt finds its way between the negative and the glass of the printing frame, or the frame is not properly made, or has warped, if the padding is unequal in thickness, a breakage easily occurs.

The negative, then, is placed in the printing frame, which, if larger than the negative, must be fitted with a piece of glass, which should be kept bright and clear on both sides. The negative, too, should be quite clean, and all the emulsion removed from the back. Brush away any dust likely to accumulate, and lay the cut sensitised paper into position without scratching the film. Place the pads of blotting paper on cloth into position, fit on the backboard and the springs or screws, and the frame is ready for exposure.

The question as to the advisability of varnishing negatives may be asked, and we strongly advise the varnishing of any negative from which a print is required on paper which contains free silver nitrate, as gelatino-chloride paper does.

EXPOSURE OF THE PRINT.

The position of the printing frame depends, of course, upon the quality of the negative. In printing from a weak negative it should be placed in a subdued light; for an ordinary negative a good strong light will give the best effect; and for very intense negatives strong sunlight is necessary. In exposing the frames to the light the only precautions that are necessary are in placing the frame in a safe place, and out of the reach of curious meddlers, and to avoid any stray rays of light, reflections, or shadows. It should be remembered that the position of the sun is continually changing with the earth's movement, and it often happens that we place our print in a shady place, and return after a little while to find the sun blazing on it, or worse still, on part of it only.

We have now to examine our print, and whenever possible, this should be done away from the strong light. It should always be remembered that the paper is considerably more sensitive to light than albumenised, and, therefore, will not permit of much exposure to the light without the chance of destroying the high lights of the image. When examining, the printing frame should always be moved to a shady place, until the operator has trained his eye to see with a rapid glance the progress of the printing operation. Another precaution to be taken is in ascertaining that the other half of the backboard of the frames than the one that is to be lifted is firmly pressed down. If the paper be shifted during the printing it is hardly possible to place it into its correct position again.

Printing should be allowed to continue until the print is much darker than required for the finished picture, as much loss takes place in the various operations it has to undergo. Observation and careful study only will guide the operator to a proper knowledge of the right tint, which differs to a slight extent, according to the after treatment to which the print is subjected. For instance, if it is the intention of the amateur to use the combined toning and fixing bath recommended in this book, it will not be necessary to carry the printing operation to quite the extent that would be required if the toning and fixing are to be done separately. And then, again, many kinds of toning baths have a stronger action upon the prints than others in lessening the brilliancy of the images.

So that it will be seen that no rule can be given in such matters as these; the only thing is for the amateur to draw out for himself a course of operation, and when he has thoroughly mastered it difficulties or mistakes will rarely arise. Gelatino-chloride paper prints much quicker than albumen. This is a decided advantage in dull weather, when a few prints only per day can be made. Vignetting, combination printing, or masking, may be effected as with every other paper.

When the prints are removed from the printing frame they are either toned at once, or may be preserved in a light-tight box until a more convenient time, which should not, however, exceed two or three weeks, as toning is thereby rendered more difficult, and the whites are liable to be degraded.

PATENT OFFICE LIBRARY

CHAPTER IV.

WASHING THE PRINTS.

THE question as to whether it is advisable to trim the prints before toning is still an open one. The author, however, does not advise it because the edges are liable to get injured in the subsequent operations, and the trimming has to be repeated, and the print cut to a smaller size than was intended. Certainly the rough edges are more likely to tear than the cut ones, but then, when the trimming is done, the torn part may be cut away.

The prints have now to undergo a good washing to remove the soluble silver salt. One thing to be remarked here is that this paper is very rich in silver, and therefore good washing is necessary, and the washing waters should be added to the residue tub. In a large dish of water place all the prints *face downwards*, move them about for a few seconds, and immediately change the water. The silver in the paper is extremely soluble, and comes out rapidly, colouring the water, which will, if not changed, give to the prints a yellow stain, which cannot be removed. The water should be changed two or three times, though the importance of rapidly changing only applies to the first water.

The prints are then ready for toning, although it will be seen that for some of the methods of toning given no preliminary washing is required.

The addition of a little common salt to the final washing water is sometimes recommended, and may be used if desired.

PATENT OFFICE LIBRARY

CHAPTER V.

GENERAL REMARKS ON GOLD TONING.

WE now come to one of the most important operations—the colouring of the print to an agreeable tint; and the first consideration is the place wherein to perform this and the subsequent operations of fixing and final washing. The first point is, that the place be clean, and further, that there is sufficient room to work comfortably in. We have to remember that in these operations we employ agents which are antagonistic to each other; and if the slightest trace of the hyposulphite comes into contact with the unfixed prints it will cause ineradicable stains. With regard to the light, it must be remembered that gelatino-chloride paper is more sensitive than ordinary albumenised paper, therefore a prolonged exposure, even to a diffused and weak light, will tend to degradation of the whites of the prints. Diffused light is, however, preferable to work in than yellow light, as it enables the operator to obtain a better idea of the tint of the picture. If the operator, however, makes it a practice to always tone by a yellow or by artificial light he will doubtless prefer to adopt the same plan with this paper. If diffused light be used it must not be too strong or actinic; and if yellow or artificial light be used it will be necessary for the operator to become used to that method of toning before he can obtain tones that will appear satisfactory by daylight.

The next chapter will treat of the different methods of toning with chloride of gold. A number of different formulæ for toning solutions are given, many of which vary in the tone they give to the finished print. Thus the amateur may select his own formula, as it is well known that tastes with regard to colour differ to a great extent; and a tone that may be pleasing to one might be considered detestable by another.

With the following toning baths it is intended that fixing shall be effected afterwards. In another chapter it will be seen that it is possible to perform these two operations in one bath. Thus the amateur has two different methods placed before him to choose from, but he must, in many cases, settle upon the manner of manipulation before commencing the printing operation, because in the toning the print loses depth, varying to a great extent, according to the kind of toning bath used; and the correct allowance for this loss must of course be made in the printing.

CHLORIDE OF GOLD.

Gold chloride is usually purchased in small hermetically sealed tubes containing fifteen grains of the substance, which should contain at least seven grains of pure gold. It is necessary to caution the amateur against buying cheap qualities of this chemical, as many times the quantity that is required of the better makes is necessary before the bath will act; and in the end he will find that he has in reality paid double the price that he would have paid had he purchased the pure article.

A most convenient method of keeping gold is to make it up into an aqueous solution in the proportion of one grain of gold chloride to one drachm of water, or, to the contents of a fifteen-grain tube add fifteen drachms of water. It is then only necessary in making up formulæ to measure out one drachm of the solution for each grain of chloride of gold recommended.

It is an exceedingly bad practice to add gold solution to a toning bath just previous to toning. In some cases, however, it may be necessary. Precautions should then be taken that the bath is well shaken, and that it is quite colourless before being used.

PATENT OFFICE LIBRARY

CHAPTER VI.

GOLD-TONING FORMULÆ.

THE following is a selection of toning formulæ suitable for gelatino-chloride papers.

Sulphocyanide of Ammonia Bath.

SOLUTION 1.

Ammonium Sulphocyanide	...	3 drachms
Sodium Hyposulphite ...	...	5 grains
Water to make	...	20 ounces

SOLUTION 2.

Water (distilled)	...	3 ounces
Gold Chloride	...	15 grains

For use add about two and a half ounces of the gold solution into No. 1, stirring vigorously the whole time until the mixture is clear, then add from three to six ounces of water. Instead of the gold solution given here add fifteen drachms of the stock solution recommended in the last chapter, and three ounces of water.

This formula is one recommended by Obernetter for his paper, and nice purple tones can be obtained with it. If a reddish-brown tone is preferred the proportion of sodium hyposulphite should be increased to ten or fifteen grains. This bath may be used many times, it being only necessary to replenish with gold solution when signs of weakness appear.

Borax Bath.

SOLUTION 1.

Borax	100 grains
Water	20 ounces

SOLUTION 2.

Gold Stock Solution (1 grain to 1 drachm)	1 drachm

The advantage of this bath is, that besides the gold only one other ingredient is necessary, and this so simple and easily obtainable. Another method of using this bath is to get a large bottle and put in it about one-third of borax, fill up with water, well shake, and let it stand. The borax solution thus formed is always in readiness if the bottle is replenished with water every time a quantity of it is used.

A great variety of tones can be obtained with this bath. It can only be used for one toning, however; but the old bath may be filtered and used instead of water for diluting the new bath.

Sulphocyanide of Ammonia, Tungstate, and Phosphate Bath.

Ammonium Sulphocyanide ...	140 grains
Sodium Phosphate	140 grains
Sodium Tungstate	100 grains
Water	24 ounces

The tungstate or phosphate may be omitted and replaced by about half the quantity of the other salt. Thus the phosphate may be replaced by an additional seventy grains of tungstate, making in all one hundred and seventy grains of the latter.

When the various ingredients are dissolved some scraps of untoned sensitised paper should be put into the solution, and the soluble salts of silver from the paper allowed to attack it. It is then filtered, and fifteen grains of chloride of gold dissolved in four ounces of water added. The above bath was recommended by Pringle. With a toning solution of this kind, however, it is necessary to use a weak fixing bath, not stronger than 10 per cent.

Acetate of Soda Bath.

SOLUTION 1.

Water	20 ounces
Sodium Acetate (recrystallised) ...	4 drachms
Gold Stock Solution	2 drachms

SOLUTION 2.

Water	20 ounces
Ammonium Sulphocyanide ...	2½ drachms
Gold Stock Solution	1 drachm

These two solutions will keep some time if kept separately. When required for use mix in the proportion of ten parts of No. 1 to three parts of No. 2. If a browner tone is required, from fifteen to twenty grains of sodium hyposulphite should be added.

Phosphate of Soda Bath.

Distilled Water	12 ounces
Sodium Phosphate	20 grains
Gold Chloride	1 grain

This bath should be used as soon as it is mixed, as it will not keep. It gives warm purplish tones.

Carbonate Bath.

Water	20 ounces
Carbonate of Lime (Chalk) ...	75 grains
Gold Chloride	15 grains

After mixing the ingredients together this bath should be left to stand for an hour. Its keeping qualities are fair, and it gives brownish-purple tones.

Bicarbonate and Acetate Bath.

Water	20 ounces
Sodium Acetate	1 ounce
Bicarbonate of Soda	40 grains
Gold Chloride	15 grains

The above is a favourite bath among many workers with gelatino-chloride of silver printing papers. Its method of preparation is to add the gold and the bicarbonate of soda to two ounces of water. This is shaken up occasionally until the mixture is quite colourless. The acetate and eighteen ounces of water are then added, and the whole is allowed to stand for about six hours. When required for use one ounce of the solution is added to half a pint of water, or the same quantity of an old filtered bath of the same kind. The stock solution will keep well. It gives rich purple-black tones. After use the bath should be filtered, and used to dilute the next bath.

Toning Bath for Sepia Tones.

SOLUTION 1.

Water	50 ounces
Ammonium Sulphocyanide ...	1 ounce
Sat. Sol. Ammonium Carbonate ...	15-20 drops

SOLUTION 2.

Water	20 ounces
Gold Chloride	1 grain

When these two solutions are mixed together a red colour appears, which will in time vanish, and leave the solution clear. When this happens the bath is ready for use, but not before. Tone to a deep purple, and wash thoroughly. On immersion in the fixing bath the pictures will turn to a rich sepia-black colour.

This bath is especially suited for the rough or matt-paper.

Dr. Jacoby recommends for his emulsion paper the following bath:—

Ammonium Sulphocyanide ...	2½ drachms
Gold Solution (1 grain to the drachm)	3 to 4 drachms
Water	16 ounces

Dissolve the sulphocyanide in the quantity of water given above, add the gold, which will immediately cause the bath to assume a red colour, shake well until clear, allow it to stand a short time, and it is ready for toning. The prints turn a deep purple in a very short time. The prints are examined by transmitted light, and removed to the fixing bath as soon as the brown shade is lost when thus examined. This bath will keep some length of time, requiring only the addition of a little gold before toning. It is well to filter after use through Kaolin.

The manufacturers of the Celerotype paper recommend the following bath for giving rich purple tones to their paper:—

Tungstate Bath.

Sodium Tungstate	¼ ounce
Gold Chloride	4 grains
Water	20 ounces

PATENT OFFICE LIBRARY

CHAPTER VII.

TONING AND FIXING OPERATIONS.

WHEN the prints are removed from the printing frame they are either of a red or a purple colour, the tint varying with the method of preparation of the emulsion. It is, then, necessary for us to alter this colour into one more agreeable to the eye. The tones usually preferred are black-brown, purplish-black, purplish-brown, or sepia. All these tones may be obtained by means of chloride of gold assisted by other substances. From the different formulæ given in the last chapter the amateur will be able to select one that gives that tone which he prefers.

Our toning bath being presumably ready, and the prints washed, we will now proceed to detail the *modus operandi.* The dish containing the prints, washed to remove the free silver, is placed to the left of the dish containing the toning solution, and to the right is placed another dish containing water.

For the busy professional it is necessary to tone large quantities of pictures at once; but the amateur is not, as a rule, troubled with great numbers, or want of time to give careful attention to their manipulation. "If a thing is worth doing it is worth doing well," is a well-known and a very true maxim, and well applies to photographic operations. Nothing looks worse than a badly and unevenly toned print, unless it be a badly mounted one.

Gelatino-chloride paper will not stand the same rough treatment that is given to albumenised paper. A large number of prints cannot be safely put into the toning solution at once. The author recommends one only if the bath be strong; if not, two or four placed back to back. By placing only a few prints in the solution the operator has the advantage of having complete control over them. With large numbers the bottom ones adhere to each other now and then, even if kept continually moving; and the effect is of course that the action of the bath cannot take place at those parts, and the picture is unevenly toned.

Take, therefore, one print from the water, place it in the toning bath, and observe the effect, which differs, of course, with almost every toning bath. The effect with the majority, however, is to turn the prints to a reddish-yellow, and then to slowly alter their colour to reddish-brown, brown, purplish-brown, and purple. The colour of the print when removed from the bath is not, however, the colour that the print will finally assume when dry. Other transformations take place, and these colours can only serve as a guide to the operator when he has become accustomed to the working of the baths. When the prints assume a purplish-brown they should be removed from the toning bath, and rinsed in a dish of water, and placed in the fixing bath, which should be kept as far away from the toning bath as possible.

FIXING.

In removing the prints from the water to the fixing bath it is necessary to exercise great care, so as to avoid any of the hypo. solution coming in contact with the prints or the toning solutions. It is advisable to have the assistance of another, or if this is not possible, use the left hand only for toning, and the right only for putting the prints into the hypo., or *vice versa*, and keeping the two always away from each other. The toned prints may also be placed in salt and water, and the hypo. only brought out when the toning solution is put away.

The fixing bath is made up of—

Sodium Hyposulphite	1 ounce
Water	10 ounces

When immersed in this the prints will lose the tone given to them in the toning bath, turning much redder. After a little while, however, their colour comes back, and it is in reality in the fixing bath that the proper tone is obtained. When this is arrived at, which should not be sooner than eight or ten minutes, otherwise the prints will not have been properly and thoroughly fixed, they are removed, and placed in a vessel containing water to undergo the final washing described in Chapter X.

One or two more remarks have yet to be made with regard to the toning and fixing of prints on gelatine paper. It should be remembered that this paper is more tender, and requires more delicate handling than any other. The film, too, is easily removed with the finger nail. In warm weather it is often necessary to put the prints in an alum bath, as described in Chapter XI. This treatment will prevent the film blistering or frilling from its paper support.

In removing the prints from the water and placing into the fixing bath, the hand should be rinsed every time it comes from the hypo. solution, because if the hypo. touches the print before it is immersed in the solution stains will surely appear. The prints should be evenly wetted with the fixing bath without delay, and kept in movement in it.

In the method of toning and fixing given the prints are merely rinsed in water between the two operations. This, however, necessitates the operator working with both the toning and the fixing bath at the same time, a very dangerous proceeding for amateurs. Another, and perhaps safer method, is to tone the prints, and place them in salt and water until all are finished. The toning bath is then put away, and the fixing operation proceeded with. When the prints, however, are washed for a longer time, the toning action in the fixing bath is not so powerful, and this fact must be remembered. Another point to be noted is that the prints, when dry, always appear darker and more violet than when wet.

PATENT OFFICE LIBRARY

CHAPTER VIII.

COMBINED TONING AND FIXING BATHS.

THE following method of toning is one which has found considerable favour amongst amateurs, as the operations of toning and fixing are performed in one solution, and trouble is avoided, and the operation is simplified. The same principle was utilised as early as 1850. A question has been raised as to the permanency of the results thus obtained, but the preponderance of evidence is decidedly in favour of this process, unless complicated by the use of less stable salts than even hyposulphite of soda.

A very simple formula is that which is ascribed to Mr. W. K. Burton, which, however, was used long before his time, but bears the stamp of his recommendation; and the addition of nitrate of lead is due to Mr. J. Chester Jervis, this being suggested as a remedy against a yellowing of the whites which might otherwise take place.

Chloride of Gold	6 grains
Nitrate of Lead	3 grains
Sodium Hyposulphite	3 ounces
Distilled Water	20 ounces

This bath is always ready for use. It will keep well, and can easily be strengthened by the addition of more gold, and may be used for some considerable time, although it is advisable not to use the bath too long, or the prints will not be properly fixed.

Liesegang strongly recommends the following bath for his brand of paper, and it will be found a good working formula for all varieties of commercial or home-made paper :—

SOLUTION 1.

Water	12 ounces
Sodium Hyposulphite	6 ounces
Alum	2 drachms
Ammonium Sulphocyanide ...	1 drachm
Common Salt	4 drachms

This solution should be allowed to stand in the open air for about seven days, then filtered, and used as directed below.

SOLUTION 2.

Water	3 ounces
Chloride of Gold	15 grains

When required for use, add seven parts of No. 2 to sixty parts of No. 1, and about forty parts of old used combined toning and fixing bath. This of course is not at first attainable, and the bottle should then be filled with odd scraps and trimmings of the paper, untoned spoilt prints, etc., or some chloride of silver may be added as suggested below.

Another favourite formula is the following :—

Solution 1.

Hyposulphite of Soda	6 ounces
Ammonium Sulphocyanide ...	1 ounce
Sodium Acetate	1½ ounces
Saturated Solution of Alum ...	2 ounces
Distilled Water	24 ounces

Fill the bottle containing this solution with scraps of paper, etc., or add to it the following mixture :—

Solution 2.

Silver Nitrate	30 grains
Sodium Chloride	30 grains
Distilled Water	½ ounce

After the lapse of twenty-four hours the solution is filtered, and the following added to it :—

Solution 3.

Chloride of Gold	15 grains
Chloride of Ammonium	30 grains
Distilled Water	6 ounces

Mr. Tylar has suggested the following, which is a very good formula, because it contains no alum :—

Chloride of Gold	6 grains
Tungstate of Soda...	60 grains
Ammonium Sulphocyanide ...	100 grains
Hyposulphite of Soda	960 grains
Distilled Water to make	8 ounces

Dissolve the salts in half the water made hot, and make the solution measure eight ounces by adding more water, then add the gold. The tungstate of soda in this bath may be replaced by phosphate of acetate with equally good results, and slight variation in tone. The following has lately been recommended in Germany for a new collodio-chloride paper, and it gives fine results on gelatino-chloride paper :—

Sodium Hyposulphite	500 grammes
Ammonium Sulphocyanide ...	55 grammes
Alum	15 grammes
Chloride of Gold Solution 1·200 ...	225 ccm.
Acetate of Lead	20 grammes
Distilled Water	2000 ccm.

Herr E. R. Liesegang has lately recommended the following as the best for emulsion papers :—

SOLUTION 1.

Hyposulphite of Soda	200 grammes
Alum	80 grammes
Nitrate of Lead (powdered) ...	2 grammes
Boiling Water	400 ccm.

The solution is allowed to stand for two days, then 400 ccm. of boiling water are added, and the solution filtered.

Solution 2.

Ammonium Sulphocyanide ...	160 grammes
Distilled Water	1250 ccm.

Solution No. 1 is added to Solution No. 2, and then solution of chloride of gold (1 per cent.) 10-20 ccm. are added.

The following bath has been given recently by Herr Wolf in "Der Amateur Photograph." It is said to tone well and quickly, it being only necessary to filter it from time to time. It is composed of :—

Water	1000 ccm.
Sodium Hyposulphite	250 grammes
Ammonium Sulphocyanide ...	27 grammes
Lead Acetate	10 grammes
Lead Nitrate	10 grammes
Citric Acid	7·5 to 10 grammes
To which is added Gold Chloride	1 gramme
Water	200 ccm.

We must now indicate the best method of mixing, using, and keeping these baths. In mixing it is advisable to dissolve all the salts in water, and after the solution has stood for the required time it should be filtered, and the chloride of gold should be dissolved in water, neutralised by the addition of a little chalk, and then filtered or decanted, and added to the other salts. All the combined toning and fixing baths either refuse to tone at all, or only tone slowly, unless they are saturated with chloride of silver. The usual method recommended is to fill the bottles with scraps of paper, etc.; but it is far preferable to add a definite quantity of chloride of silver, formed by a mixture of nitrate of silver and a soluble chloride, as indicated above. When a bath has been used for some time a black precipitate frequently settles down. This, however, need not be taken any notice of, and is sulphide of silver, and may be filtered out, or the solution decanted from it.

An important question is, How long can a bath be used? A moment's consideration will show us that this is not dependent upon the amount of gold in the bath, but upon the saturation of the hyposulphite with silver salt, as its powers in this respect are not limited. The best practical test for the age of a bath, or its suitability for use, is to note whether the half tones tend to a greenish hue or not. If there is the slightest sign of this the bath should be at once rejected, and either placed amongst the residues, or preferably used for mixing with a new bath, so as to saturate it with chloride of silver. Other faults and failures in the toning process are treated of in Chapter XIV.

Mr. E. J. Wall, the author of "The Dictionary of Photography," has pointed out that the presence of alum in a toning bath introduces an element of decomposition and possible chance of sulphur toning, one of the surest methods of producing yellow and fading prints. When alum and hypo. are mixed a decomposition occurs, which is represented by the following equation :—

$$3\ Na_2S_2O_3 + Al_2\ 3\ So_4 = Al_2\ O_3 + 3\ S_3 + So_2 + 3\ NA_2\ So_4,$$

from which it will be seen that oxide of aluminium and sulphur are deposited and sulphurous acid set free. It is to allow of this reaction in the toning baths that we are told to allow the stock solutions to stand for so many hours before adding gold. Now all photographers know that nascent sulphur and free sulphurous acid are generally considered to be the most useful agents for producing yellow whites and fading prints. The addition of alum to a toning bath is considered necessary for two reasons —first, to prevent the sulphocyanide exerting its peculiar solvent action on the gelatine film; and secondly, to make the action of the bath even and regular. The objections against its use are,—first, decomposition of the hyposulphite, with setting free of sulphur and sulphurous acid; secondly, a possibility of yellow whites; thirdly, shortening the life of the bath; and fourthly, equally good results can be obtained by the omission of the alum. The further consideration of this will be treated of in the chapter on hardening and tanning prints.

Mr. Wall further suggests the use of a second fixing bath of 10 per cent. strength as being more conducive to the elimination of the hyposulphite of silver, which is in so many cases the cause of the instability of silver prints.

After toning, the prints should be washed in the manner indicated elsewhere.

ENT OFFICE LIBRARY

CHAPTER IX.

PLATINUM AND URANIUM TONING.

THIS little work would certainly not be complete were I to leave out a description of the method of toning by platinum now gradually gaining favour. The formula most suitable to gelatino-chloride paper is the ordinary developing solution recommended by the Platinotype Co., which is made up as follows, and was first recommended by Mr. Alfred Stieglitz for this purpose :—

Solution 1.

Oxalate of Potash	5 ounces
Monopotassic Orthophosphate ...	3 ounces
Water	50 ounces

Solution 2.

Potassium Chloroplatinite ...	60 grains
Water	2 ounces

For use take three parts of Solution 1, one part of Solution 2, and add two parts of water.

Instead of the phosphate of potash in Solution 1 the oxalate may be increased to eight ounces.

It is necessary here to caution the reader against purchasing anything but the true chloroplatinite of potassium, and not the ordinary platinum chloride, a bichloride usually sold in fifteen-grain tubes.

Lyonel Clark, in his admirable little treatise on platinum toning, gives the following instructions for toning :—

For holding the toning solution a glass-bottomed dish should be employed, the same as generally used for developing bromide papers. This is turned upside down, so as to have the sides as low as possible, and three levelling screws attached to the upper edge, which is now the lower one ; and with these and the aid of a spirit level the dish is adjusted. By this means the toning solution is spread over a large area in a thin but uniform layer, two ounces being sufficient to cover a dish measuring 18 × 15 inches.

The wet gelatino-chloride print, thoroughly washed and freed from silver, is next taken, and holding it by opposite corners, one in each hand, place one corner on to the surface of the liquid with the left hand first, and then lowering the right hand allow the print to gradually float on to the liquid, in this manner pushing in front of it any bubbles that may have formed on the surface. The print is lifted off the toning bath as often as thought desirable, and the progress of the toning examined by transmitted light. If any redness is still observable in the deeper shadows of the picture it must be replaced. When, however, this redness has entirely disappeared the toning is complete. The picture is then slowly lifted from the liquid to allow of no waste of the solution, and thrown into a dish of water rendered alkaline by carbonate of potash or soda, or if the hyposulphite fixing bath be rendered alkaline this addition is not necessary. The toning bath will not keep more than two or three days.

The fixing bath should be about one of hypo. to five of water, and a few drops of ammonia added.

With platinum toning the processes of printing, fixing, and washing are carried on in the ordinary manner.

It is often considered advisable to place the gelatine prints before toning into a saturated solution of alum. This will effectually harden and prepare them for the handling in the subsequent operations.

The tones obtained by this platinum method are very pleasing, and all operators should give it a trial. The process is not a difficult one, and very little more trouble than with gold toning.

TONING WITH URANIUM.

The following formula has been specially recommended as giving fine tones, especially with matt surface prints :—

Chloride of Gold	4 grains
Uranyl Nitrate	4 grains
Chloride of Sodium (Salt) ...	60 grains
Acetate of Sodium	60 grains
Distilled Water	16 ounces

Neutralise the gold and uranium, previously dissolved in a little water, with bicarbonate of soda, or chalk.

Stieglitz's method of toning with uranium is as follows. The bath is made up of—

Gold Chloride	0·25 gramme
Uranyl Nitrate	0·25 „
Sodium Bicarbonate	5 grammes
Distilled Water	300 ccm.

and should be used immediately, as it does not keep. The prints are made very intense.

The following is the fixing bath specially recommended for use after this method of toning :—

Hyposulphite of Soda	2 ounces
Salt	1 ounce
Bicarbonate of Soda	$\frac{1}{4}$ ounce
Distilled Water	20 ounces

PATENT OFFICE LIBRARY

CHAPTER X.

WASHING THE PRINTS.

A SEPARATE chapter will be devoted to the washing of the prints because of the vital importance, if permanent prints are required, of washing well. By this is not meant washing for a great length of time, but washing thoroughly. Upon this the permanency of the finished print depends.

Another thing to avoid is the so-called hypo. eliminator, the majority of which certainly remove the hypo., but only by converting it into an equally disastrous compound. Water is the most efficacious eliminator of the fixing salt.

Too prolonged washing is just as bad, however, as too short. Gelatine, when kept in the moist state for any length of time, will commence to decompose, and there is no doubt that this action, once set in, would have a considerable effect upon the permanency of the image. Quick and thorough washing is desirable. This is only accomplished by a number of changes of water at short intervals. The most effective way to remove the soluble fixing salt is to wash for a few minutes in water, and then to lay the print upon a sheet of clean glass and squeegee all superfluous moisture from both back and front. It is then laid in a fresh dish of clean water for a few minutes, and the operation repeated several times.

PATENT OFFICE LIBRARY

CHAPTER XI.

TANNING AND HARDENING THE PRINTS.

GELATINE is a substance so susceptible to moisture and accidental injury, that the beautiful polish that is given to the prints will soon depart, and the picture becomes less brilliant. In order to obviate these defects many methods of hardening the film have been recommended, which also have the effect of rendering the pictures much more permanent. Among others is that by tanning. The solution is made up as follows :—

Distilled Water	36 grains
Tannin	15 grains
Sat. Sol. Potas. Aluminium Sulphate	3½ ounces
Sodium Chloride	2 drachms

Into this bath the prints are placed for about five minutes ; they are then thoroughly washed. In every case where an alum bath is used either before or after toning, it is absolutely essential that copious and thorough washing should take place, otherwise decomposition of the hyposulphite or sulphocyanide will ensue, as already pointed out.

Unfortunately, however, gelatine is a substance which combines chemically with tannin, and this compound, as well as the paper, in time gradually turn yellow, or yellowish-brown; therefore this method cannot be confidently recommended to give the best results. Another method which is often used is that of immersing the films in a saturated solution of potash alum. Dr. Stolze, however, has pointed out ("Phot. Wochenblatt, 1889," p. 266) that alum has always an acid reaction, and that in time prints treated with this bath have a tendency to turn yellow, and recommends the following as the most suitable bath for tanning or hardening gelatino-chloride prints :—

Chrome Alum	1 part
Distilled Water	100 parts

Dissolve, and add ammonia drop by drop, till a permanent precipitate is formed on shaking the solution. The liquid is then filtered, and the prints bathed in it for three or four minutes. Mr. Wall recommends the use of this bath previous to toning all prints, and omission of the alum from the toning bath, as stated in Chapter VIII.

◆

LIBRARY

CHAPTER XII.

ENAMELLING THE PRINTS.

OUR washed prints are now in the bath awaiting further treatment, which the worker must next decide upon. One method adopted is that of enamelling, which is done by simply laying the prints face downwards on to waxed or talced glass, and allowing them to dry in that position. When they are removed the gelatine takes a surface equal to the glass itself in polish. Another method is to allow the prints to dry on ground glass, to give a matt surface, which gives far more pleasing and artistic results ; or they may be permitted to dry spontaneously and then burnished. I will, first of all, describe the method of giving the prints a glossy surface. The materials required are some sheets of plate glass, French chalk, or solution of wax, a squeegee, blotting paper, cotton wool, and a piece of American cloth.

The first operation is to clean the glass. It is not absolutely essential that it should be plate glass, that known as Patent Crown gives the best results and fewer failures. If the glass is not clean the prints will stick. One of the finest things for cleaning glass is Brooke's Monkey Soap. This has been found very efficacious for removing grease and other impurities. When the glass has been well washed it should be polished with a piece of chamois leather. A little of the French chalk (powdered talc) is then dusted over it with a tuft of cotton wool, and well rubbed into the glass, and then dusted off again. No chalk should be visible on the glass, although the pores of the glass are in reality filled with fine particles. When the chalk is dusted off again it should be noted whether the glass still appears quite clean. If there are any white patches of the chalk adhering to the glass visible, the plate should be cleaned over again, and fresh chalk applied. On no account should attempts be made to squeegee the prints on to the glass unless perfectly assured of its cleanliness, as one can be absolutely certain that if the prints are put on there they will remain, defying all efforts at removal, except in little pieces. When the chalk has been rubbed in, one or two sweeps with a clean silk handkerchief should remove all visible traces of it. If any lumps of the chalk are left on the glass they will be visible afterwards, marring the beauty of the finished gloss.

An alternative method of preparing the glass is by pouring on to it a little ethereal turpentine, or benzole solution of yellow wax, made as follows :—

Yellow Resin	36 grains
Yellow Wax	24 grains
Turpentine, Ether, or Benzole ...	2 ounces

A pool of this solution is poured on to the centre of the plate, and spread all over by the aid of a tuft of cotton wool, and then polished with another piece of wool ; and although the glass appears perfectly clean, it is really covered by a very fine film of wax.

All the glasses having been treated in this manner, the prints are placed in water till thoroughly limp, and taken out one by one, and laid face downwards upon the glass. Not more than four prints should be placed on one glass, which should be sufficiently large to take this number. A piece of the American cloth, cut a size larger than the glass, is then laid over the prints, and with a squeegee they are pressed into closer contact with the glass, all air being excluded from between the paper and the glass. The presence of air is easily detected if the glass be reversed and the opposite side carefully examined. The cloth is then removed, and a few pieces of blotting paper laid on the top of the prints. Many workers prefer to use a sheet of glass for each print, and in a small dish of water lay the waxed glass, and the print on the top of it, bringing them out of the water and then squeegeeing.

When all the prints have been laid on to glass in this manner they may be removed to a warm room and allowed to dry spontaneously. Artificial heat should not be used to hasten the drying.

Instead of a glass plate the prints may be squeegeed on to other substances, such as a clean ferrotype plate. Many of the manufacturers now supply sheets of polished celluloid, or ebonite, or metal. The surface that is given to the prints of these is not so fine as with plate glass. The only advantage to be gained by their use is that the necessity for treating with chalk is obviated.

When the prints are thoroughly dry they will either detach themselves from the glass, or may easily be removed by raising one corner with a penknife and carefully pulling them away. If they show any signs of sticking no attempt should be made to remove them until they have been allowed a further time to dry. Prints attached to glass in this manner often feel dry at the back, but the film, the most important part, is still damp, and in this state will adhere very firmly to the glass, and withstand all efforts to remove them. A good plan, after the prints are apparently dry, is to apply artificial heat, as this can be done with safety. It is important that the perfect dryness of the film be assured before attempting to remove, for if the print be partly removed and found to stick, the remaining part requires to be further dried, and an ugly uneffaceable mark is left upon the surface.

The prints removed from the glass are now ready for mounting. They should be laid one upon the other, face downwards, a piece of cardboard placed at the top, and the whole kept flat with a weight.

To obtain the dull matt surface so suitable for some class of prints, it is only necessary to employ ground glass and treat in the same manner. The glass for this purpose should be very finely ground, as used for focussing screens. If this is not easily obtainable, it can be made by grinding two sheets together with some very fine emery powder made into a thin paste with water; one sheet is firmly fixed to a table, a little of the paste spread over it, and the second sheet, held by a pneumatic holder, is moved about in all directions on the first until evenly ground all over. In squeegeeing the prints to the matt glass, extra pressure must be used to press the gelatine into the fine pores, otherwise little shiny patches will appear to mar the dull matt surface.

The prints can also, as before stated, be dried spontaneously and burnished and rolled. It must be noted that an aqueous solution of Castile soap should not be used in burnishing, but an alcoholic one.

PATENT OFFICE LIBRARY

CHAPTER XIII.

TRIMMING AND MOUNTING.

IN mounting photographs, especially those upon gelatino-chloride paper, the utmost neatness and cleanliness should be observed. It is for this reason perhaps that ladies are so much more successful than the sterner sex, whose fingers are generally all thumbs. Nothing looks worse than a badly mounted print. No matter how artistic the picture may be, its effect is ruined if no care is taken in the mounting of it.

The first operation is the trimming of the prints. For this we require a large piece of zinc or thick glass for a cutting slab, and some ground glass cut into shapes of the required sizes. The object of having the glass ground is to prevent the prints from slipping about whilst being trimmed, as they are very likely to do, owing to the slippery nature of the polished surface. The ground glass must not, however, prevent the picture being clearly seen; for this reason some prefer to have only parts of the plate ground. The other necessary implement is a sharp penknife or trimmer. The print is laid face upwards upon the zinc plate, the cutting shape arranged in the required position, and the knife drawn along the four sides, keeping close to the edge the whole way. Always try and sever the paper at one cut, and be careful to keep the shape firmly pressed against the print. See that your cutting glasses are clean, and free from moisture.

The prints, having all been carefully trimmed, are ready for mounting. The selection of the mounting boards is treated upon in the chapter on permanency, which it would be well for the worker to study.

The best mountants for this kind of paper are undoubtedly those made with gelatine and alcohol, or alcoholic solution of shellac and mastic, or solution of indiarubber in benzole. Other mountants, such as starch, paste, etc., are of no use for this purpose, as the water soaks rapidly through the back and dulls the brilliancy of the surface. The following is the formula for the gelatine mountant :—

Gelatine	2 ounces
Water	2 ounces
Alcohol	4 ounces
Glycerine	½ ounce

First soak the gelatine in the water for six hours, and then dissolve by the aid of a gentle heat. Next add the glycerine, and lastly, the alcohol, in very small quantities, stirring between each addition. Do not allow the gelatine to get too hot, as it soon loses its setting properties. For this purpose Nelson's Amber Gelatine will be found quite suitable.

The print is laid face downwards upon a clean sheet of blotting paper, and the mountant applied with a stiff brush while warm. The utmost care must be taken that none of the solution touches the face of the print, as it cannot afterwards be removed without leaving an unsightly mark. Neither must too much be applied, as it will ooze out from the edges. Wipe your fingers, and carefully raise the print, placing it in the correct position on the mount, lay over it a sheet of white paper, and go over this with a handkerchief or piece of soft rag, pressing the print well into contact with the mount. The mounted print should then be laid face upwards to dry, nothing being laid upon it while it is damp.

With a mountant of this description very little of the gloss will disappear. Many workers, however, prefer to mount the edges of the print only. This is done by laying over the back of the print a piece of paper cut a quarter of an inch smaller each way. The brush is then drawn round the edges only. The paper is then removed, and the print attached to the mount in the manner already described. If this method of mounting be adopted the prints should be previously placed in a damp room or cellar, because if they are mounted in this manner when too dry they will be liable to cockle in the centre, and spoil the effect.

The alternative methods of mounting by the aid of alcoholic solution of shellac and mastic are slightly more difficult to successfully perform ; but with these the high gloss, which is sometimes lost or deteriorated by the first method, is preserved entire. The alcoholic shellac mountant was suggested by Mr. Romyn Hitchcock in *Anthony's Bulletin*, and it will be found useful for all photographic mounting, as there being no ingredient likely to turn acid, which is conducive to yellow and fading prints, it may be used with safety. The method of making this mountant we give in the author's original words : "The prints must be first dried in such a manner that when unrolled they will be quite free from wrinkles, and smooth. My plan is to wet them, and squeeze them down on a polished surface, from which they can be easily removed when dry. Ebonite plates serve very well for this purpose, but I had a set of lacquered plaques made for the purpose in Japan, which I much prefer. The prints are squeezed to these plaques, which are piled up, with blotting paper between them, and weighted down. When the prints are quite dry they are rolled up singly, and thus they keep smooth until required for mounting.

"The cement is prepared as follows : Good bleached shellac is broken into pieces the size of small peas, placed in a wide-mouth bottle, and enough strong alcohol to cover it poured in. The bottle is then placed in water, which is slowly heated to boiling. A solution is thus obtained, which becomes gelatinous when cool. It should be of the consistency of vaseline at ordinary temperature. As thus prepared the shellac, thinned with a very little alcohol, can be used for mounting, but is very much improved by the addition of a small proportion of mastic dissolved in chloroform. An ounce of mastic is dissolved in two ounces of chloroform, and the solution filtered through a bit of sponge stuffed into the lower part of a wide glass tube, the end of which is drawn out. I use a test-tube drawn out at the bottom for this purpose.

"The proportion of mastic solution to be added depends upon the strength of the shellac solution. About one-sixth the volume of the latter is a good proportion if the shellac is quite thick, and a small proportion of alcohol may be required; but it is important that the proportion of the latter should not be sufficient to thin the mixture too much, for a thin solution is apt to penetrate quite through the print, and to show on the face. The object of adding the mastic is to make the cement work smoothly under the brush.

"I have found that if the constituents are properly proportioned the prints will not curl when the cement is applied to the backs. But I am not always able to obtain this very desirable result with a new mixture until after successive trials. The cement should be of the consistency of thick molasses, and should flow easily under the brush.

"My method of applying it is as follows: I place the print face down on a smooth sheet of paper on a glass plate, and spread the cement evenly with a brush. Then, picking up the print with two hands, I lower it upon the paper on which it is to be mounted, which also lies on a plate of glass, but only allowing one end of the print to touch the paper. The position of this end should be previously marked with a pencil. Now placing the edge of a heavy paper-weight on this end of the print, I lower the other end slowly, running a straight bone paper-knife over the face from left to right, to keep the print smooth and to drive out air-bubbles. The print should then lie flat, and when the edges are pressed down all around it may be vigorously rubbed with a dry cotton cloth. Should any cement have got on the surface it may be removed with alcohol.

"I deem it important to work always on glass surfaces, for the prints must be kept quite smooth all the time.

"Some time ago Professor O. N. Rood recommended a solution of shellac in alcohol for mounting prints. The ordinary solution has not proved satisfactory in my hands.

"The secret of success in my process is the use of shellac prepared in the manner described. That portion of the shellac insoluble in alcohol is essential to the process. The solution does not dry rapidly like ordinary varnish, but retains its gelatinous condition for a considerable time. It is not very sticky at first, as may be readily observed by testing it between the fingers. As the alcohol passes off it becomes more sticky. The addition of mastic makes it adhere better while still soft."

The indiarubber mountant is made by dissolving—

Pure Masticated Rubber ...	10 grains
Benzole	1 ounce

and applying with a brush. One of the chief drawbacks to this solution is its tendency to dry hard and crumble after a time, causing the picture to leave the mount either partly or wholly.

It may be as well to state that it is not absolutely necessary for the worker to prepare his own mountant. Many similar compositions are now sold by dealers which answer the purpose equally well, and a small bottle will suffice to mount a great number of prints, and the commercial adhesive mounts will be found quite satisfactory.

If the foregoing instructions are carefully carried out there is no reason why such result should not be a thing of beauty and a joy for ever.

Perhaps the most effectual way of mounting these prints without any loss of brilliancy is to employ cut-out mounts. With these the print is mounted behind the opening by gluing the edges only. A sheet of thick paper is then mounted on to the back by applying a mountant to the board only, and without touching the back of the print, which is thus left free. Prints mounted in this manner should be previously removed to a damp cellar for a few minutes, as if they are mounted in a too dry state, they will afterwards cockle up, and become unsightly.

A method of mounting the prints while upon the glass has been recommended, the details of which are as follows, but it requires some considerable practice and care to successfully perform. Whilst the print is in contact with the glass, and when the back feels nearly dry, apply freshly made and stiff starch paste with rather a stiff hog's-hair brush, and work it slightly into the surface of the paper, then allow it to dry, and strip as usual. The mount is carefully marked in the exact position the print should occupy, and is then damped with a clean soft sponge wet with clean water, and the print applied, and pressed or squeegeed into contact.

Another method is as follows: The prints are trimmed at some time previous to putting on to the glass. When partly dry the mounting solution is applied to the back, and the glass lifted up, and the sticky print laid on to the mount. Its position can of course be seen through the glass. When quite dry a sharp penknife is inserted between the gelatine film and the glass, and the mount with the print attached to it will leave the glass together. For convenience in detaching, the glass used should only be a little larger than the trimmed print. No attempt should be made to force the print from the glass. It should be remembered that a long time is required for drying, as the mount at the back prevents the air from carrying away the moisture.

PATENT OFFICE LIBRARY

CHAPTER XIV.

FAILURES.

NOTHING succeeds like success we are told, and nothing is so conducive to success as failures.

I have endeavoured to give as clear a description of the working of the process as possible; and as I cannot, however, guarantee the absence of failures, the next best thing to do will be to give a description of the different failures the operator is likely to meet with, and explain their causes and remedy when possible. The long list of these (every one possible being given) will not, it is hoped, frighten the tyro, and cause him to fear that he will meet with all of them. If the instructions given be carefully carried out it is possible that he will meet with but one or two, which he will be able to quickly remedy.

FAILURES IN CUTTING THE PAPER.

Stains upon the paper result from handling the sensitised surface. This should be avoided as much as possible. It also results from placing the paper upon unclean surfaces. Waste in cutting should be avoided. It should not be cut too small nor too large. A little thought will remedy this, or practise on a sheet of ordinary paper cut to the same size as the full sheet.

FAILURES IN PRINTING.

Breaking of the negative is an easy thing to accomplish. The slightest piece of grit between it and the glass of the printing frame will cause it. Warped or badly constructed printing frames will easily crack it, or if the pads be unequally laid on.

Double outlines are caused by carelessness in opening and shutting the printing frame during the progress of printing, or to the springs of the frame being too weak. This will also cause blurring. Extra pressure may be obtained by using two or three sheets of blotting paper between the print and back. Brown spots upon the negative are caused by the negative or the paper having been damp. The best method of removing them is by immersing the negative in water, and then gently rubbing the film with a pad of cotton wool soaked in weak solution of cyanide of potash, or by touching the stains with a weak aqueous solution of iodine in iodide of potash, and then applying the cyanide solution.

White spots upon the paper are caused by dust between the negative and the paper. Brush the negative with a clean camel's hair brush before laying down the sensitised paper.

Unequal sharpness is often caused by not placing the back of the frame into correct position, or by unequal padding.

Dull high lights are the result of opening the frame in too strong a light.

FAILURES IN WASHING THE PRINTS BEFORE TONING.

Stains are produced by splashes or unequal washing. The prints will also become stained a brown colour if allowed to remain too long in the first washing, or if there is an insufficient quantity of water. Make the first changes rapidly. They may also become covered with a white deposit, due to the hardness of the water, if washed face upwards.

FAILURES IN TONING.

Uneven toning is produced by attempting to tone too many prints at the same time, or by the bath containing too much gold, which will cause it to act so quickly that there is insufficient time to control its action. Uneven toning may also be caused by the prints sticking together in the bath, or by injudiciously adding gold when the prints are in the bath. Too strong a gold bath may generally be detected by the edges and half tones turning blue and then slaty-blue before the other parts of the print have reached the purple stage. The obvious remedy is dilution of the bath ; but if the prints be first treated with the alkaline chrome alum bath mentioned on p. 43, a strong bath may be used without any ill effects, as the penetration of the liquid is then much slower and more even. The use of too weak a gold bath tends to give rosy half tones or rosy tints in the half tones, and an old or worn-out bath tends to greenish half tones.

If the bath refuses to tone there may be either an insufficiency of gold, or what is a great deal more probable, the bath is not sufficiently saturated with chloride of silver, which is an essential for successful toning. Prints refusing to tone in patches may at once be set down as due to contamination from greasy, or hypo.- contaminated fingers, if the patches have a clear defined shape; but where irregular patches occur which refuse to tone, it is due either to partial washing or some reason which cannot be definitely stated. A preliminary alum bath, however, entirely prevents this.

FAILURES IN FIXING.

Splashes will produce stains. Finger-marks appear if the prints are touched previous to fixing with hands contaminated with hyposulphite.

The prints lose all their tone in the bath. This effect sometimes takes place, and the tone refuses to return. It results either from insufficient printing, insufficient toning, or from too strong a fixing bath. The prints may sometimes be saved by adding a little gold solution to the fixing bath, and allowing it to act upon the pictures.

Yellow spots are the result of imperfect fixation.

Yellow prints. A worn-out fixing bath, or one containing free acid, will stain the prints yellow. In the latter case add a little ammonia to neutralise with test paper, or make it slightly alkaline, or the use of the ordinary alum or tannin solution for hardening them. Unequal immersion in the fixing solution will cause stains and streaks to be produced.

FAILURES IN WASHING.

If the washing after fixing be imperfect the prints will turn yellow.

Torn prints are the result of rough handling or too strong a flow of water. Blisters form, or the film leaves the paper. These defects will sometimes occur in warm weather if the alum bath has not been used. At that time of the year it is advisable to place the prints into the alum bath before toning.

FAILURES IN ENAMELLING.

The principal failure in this part of the process is in the prints refusing to leave the glass when dry. In the first place, the operator must assure himself that they are dry. If the print is quite dry, and the whole or part of it sticks to the glass, no force should be used to remove it. The only method is to lay the whole in a weak solution of hydrochloric acid, when the print will detach itself from the glass, and may be again placed upon another sheet of glass. The principal causes of the prints refusing to leave the glass are in the use of an imperfectly clean glass, or insufficient application of the chalk or wax solution. The first defect, however, is the principal one, for if the glass be clean no chalk is required. This applies only to a good quality of glass. With this kind the failures are much fewer.

When the prints show signs of sticking to ebonite, celluloid, or iron plates, it is necessary to rub the plates over with a piece of flannel containing one or two drops of sweet oil.

Marks upon the polished surface are caused by impurities in the glass, or by using force in detaching the prints.

Small dull patches on the polished surface, or small bright spots on the matt-surfaced print, are due to imperfect removal of the air between the film and the glass.

FAILURES IN MOUNTING.

A bad mountant will stain the print.

An inartistically cut picture is the result of carelessness, or want of artistic taste.

Marks on the surface caused by the mounting solution are easily visible. Every care should be taken, as they cannot be removed without leaving a distinguishable mark.

Prints will not adhere if the mountant be too weak, or if the gelatine has been heated to too great a temperature. Loss of brilliancy in the finished print is caused by too thin a mountant, or by damp atmosphere. If a thick mountant be used, like the one given, it cannot penetrate the paper farther than the chalk substratum beneath the sensitive film. The alcohol, too, serves to dry it quickly. If any thin aqueous mountant be used the loss of brilliancy is certain. To those, however, who cannot succeed in mounting their prints without a considerable loss, I would advise the method given of mounting the edges only either with the gelatine mountant or with an indiarubber solution, or a cut-out mount may be used in the manner described in the chapter devoted to mounting.

Small white spots in the print can be retouched with a fine brush and some colour mixed with a little gum, so that the spots will not show dull on the polished surface. It should be done with much skill and care, as the appearance of the print can be easily spoilt. If the negative be carefully retouched nothing should be necessary in the finished print.

ENT OFFICE
LIBRARY

CHAPTER XV.

PERMANENCY.

THE question of the permanency of the silver print and the probable cause of fading is one that has occupied the attention of leading men, who have apparently come to conflicting conclusions. Able professors have written learned treatises, showing the various actions undergone by the molecules of which the print is composed in the presence of air, and when attacked by foreign substances which float about in our atmosphere. In an album containing albumen prints made by my father some thirty years ago, are many prints which show every sign of reasonable permanency, while others are hopelessly faded. The reason of this was explained by the fact that those which remained perfect had been thoroughly washed. The others had been left to the Chinamen, who, with their natural dislike to labour and preference for slumber, had not devoted the time and attention that was necessary. I maintain that a print made upon pure paper, washed as described in Chapter X., to free it from all soluble matter, and mounted upon chemically pure boards with chemically pure starch, will remain in perfect condition for at least fifty years. The principal causes of fading are in the use of paper which is not chemically pure, in the imperfect washing of the print, and in the mounting upon inferior boards, or with an inferior mountant.

The two latter causes are clearly proved from the fact that mounted pictures made many years ago have nearly all faded to a greater extent than those made at the same time which have never been mounted.

But what we have to deal with here is the superior permanency of gelatino-chloride prints. That they are more permanent is now almost universally admitted. When I first interested myself with this process these lasting qualities of the prints claimed much of my attention. Some prints were made upon albumenised paper and upon gelatino-chloride paper from the same negative, and subjected to the same toning, fixing, and washing operations. When dry they were fastened by pins to a board, covered halfway over with black paper, and exposed in a position where they would receive the greatest amount of sunlight. After three months the albumen prints were almost invisible, while the gelatino-chloride print, except a slight yellowing of the paper itself, had not suffered.

This property of gelatino-chloride prints may perhaps be clearly explained. It will be seen that in the composition of the emulsion a large quantity of the sensitive salt is a definite silver compound emulsified in gelatine. In the albumen process we get silver albuminate, a most unstable organic compound. Then again, the sensitive film lies upon the surface of the paper, supported there by the chalk layer underneath, which prevents it from sinking into the paper. The advantage of this is apparent. The length of time taken to remove the various chemicals from this thin film is very short, and upon this one of the secrets of the prevention of fading lies.

It only remains to add, that in order to secure permanent results some little care should be taken in selecting the mounts to be used, or the paper or boards of the album. It is well known that in the manufacture of mounting boards large quantities of chemicals are used, among others the photographers' friend and enemy, hypo. The use of mounts containing any foreign substance of this kind must be carefully guarded against; and for the worker who consumes small quantities only it is advisable to purchase the very best cards that can be procured. The mountant, too, should be simple, and contain no unnecessary matter likely to have a deleterious effect upon the print.

PATENT OFFICE LIBRARY

PART II.

PREPARATION OF THE SENSITISED PAPER.

CHAPTER I.

INTRODUCTION.

IN the second part of this book we will consider the method of preparing gelatino-citro-chloride of silver emulsion, and the method of applying it to paper and other substances.

It was originally intended that this little work should only contain a description of the manipulations necessary for the successful treatment of the papers now placed in the market. But subsequently these directions were extended so as to include the actual manufacture of the paper itself, so that any one could, if so disposed, prepare his own paper. The process is not a tedious one, but at the same time much care and thought must be used, otherwise failure is inevitable. Many workers have neither the time nor convenience for manufacturing paper at home, but others, again, may be glad to have a handy *résumé* of the needful operations for this purpose.

NT OFFICE
LIBRARY

CHAPTER II.

CHOICE OF PAPER.

UPON the choice of a suitable paper much of the success rests, and it will therefore be necessary to give this point a little consideration. Some experiments that have been recently made tend to show that very few kinds of paper are suitable. The various substances employed in the sizing of the different papers exert a very marked action on the emulsion. Many of them contain chemicals which have a detrimental effect upon the emulsion. As soon as the emulsion comes into contact with the said coating, chemical changes take place, and the silver salt is frequently reduced to the metallic state. When a free chloride is present, which is frequently the case, silver chloride is formed, the amount of free silver in the paper is lessened, and weak prints are the result.

The paper used by most of the makers of gelatino-chloride papers is that known in Germany as Baryta Paper or Kreide (Chalk) Paper. This may be obtained from any dealer in this country who supplies materials for collotype work, as it is largely used for this. It is a paper coated with a heavy film of barytes or chalk of different tints. The advantage of using a paper of this description lies in the fact that the substratum helps to keep the film of sensitive emulsion upon the surface of the paper. The result is, that considerably more detail is obtained than from a paper in which the sensitive salts are more in the fibre of the paper. Indeed it is astonishing what a lot of fine detail is lost in albumen printing where the film lies embedded, to a certain extent, in the paper.

Other plain papers that can be used with safety are Rives's, Saxe's, and Arnold's papers. The latter is a specially pure unbleached paper manufactured in England, and sold by Reeves & Sons. A defect frequently found in other English-made papers is the presence of small particles of metal. These may be so small as to be perfectly invisible to the eye, yet as soon as the sensitive emulsion is applied they form visible black spots. Paper that has been rolled with hardened paper-pulp rollers does not contain this defect.

Besides paper the emulsion may be coated upon glass, wood, leather, or any undyed fabric that will not be injured by water.

ENT OFFICE LIBRARY

CHAPTER III.

PREPARATION OF THE EMULSION.

THE simplest apparatus that can be used in the preparation of the emulsion and in coating the paper will only be described. For making the emulsion, then, we require two or three clean 1 lb. salt jars with lids, some glass rods, a couple of measuring glasses, an iron saucepan to comfortably contain one of the salt jars, some pieces of fine muslin, and a glass thermometer for testing the temperature of liquids.

Hardwich was the first, in 1856, to suggest the use of a gelatine paper, and his formula was as follows :—

Citric Acid	6·5 grammes
Carbonate of Soda	q. s. to neutralise
Chloride of Ammonium	6·5 grammes
Gelatine	0·6 grammes
Water	300 ccm.

Paper coated with this solution and dried was sensitised with nitrate or ammonia-nitrate of silver. In 1882 Abney suggested a gelatino-citro-chloride emulsion, and gave the following formula :—

A.

Chloride of Sodium	3·7 grammes
Citrate of Potash	1·8 grammes
Water	30 ccm.

B.

Silver Nitrate	11 grammes
Water	50 ccm.

C.

Gelatine	15 grammes
Water	175 ccm.

B and C are mixed together, and then the emulsion formed in the usual manner by adding A. When set, the emulsion is washed slightly for a quarter of an hour in cold water, drained and melted, and 15 ccm. of alcohol added.

Ashman and Offord carried out a series of experiments with this emulsion, and recommended the following process, in which two emulsions are used :—

No. 1. *Chloride Emulsion.*

A.

Gelatine	3 grammes
Ammonium Chloride	0·64 grammes
Distilled Water	33 ccm.

B.

Silver Nitrate	2 grammes
Distilled Water	10 ccm.

The gelatine is allowed to soak in the water, the chloride of ammonium added, and the whole melted by the aid of a gentle heat, and then B added. When the emulsion is thoroughly mixed a little should be taken out and allowed to drop on to a clean china plate, and tested with a drop of neutral chromate of potash, to see if there is free nitrate of silver, which is immediately evident by the intense orange-red colour formed. If silver be in excess, a few drops of a solution of chloride of ammonium must be added to remove the same. The second emulsion is a citrate of silver emulsion with an excess of nitrate of silver.

No. 2. Citrate Emulsion.

A.

Gelatine	3 grammes
Distilled Water	30 ccm.

B.

Citric Acid	2 grammes
Distilled Water	10 ccm.
Ammonia	q. s. to neutralise

C.

Silver Nitrate	2 grammes
Distilled Water	5 ccm.

The gelatine is allowed to soak for an hour in water, and is then dissolved by heating gently. B is added, and then C. One part of this emulsion is to be mixed with three, four, or five parts of the chloride emulsion. The more citrate emulsion the redder the tone of the prints before toning, and the browner after. The best proportion is one of citrate to four or five of chloride emulsion. This mixture gives deep rich purple tones. The emulsions, when mixed, are allowed to set at once, or, if at all granular, may be heated in a water bath at a temperature of about 80° C. for about five minutes, then allowed to thoroughly set, squeezed through canvas in the usual manner for bromide emulsion, washed for five minutes with constant stirring in water, the washing water added to the residues, and fresh clean water added to the emulsion, and again washed for five minutes, the emulsion then collected, drained thoroughly free from water, melted, and used.

Ashman has since published the following as an improved formula :—

A.

Citric Acid	20 grammes
Distilled Water	100 ccm.

Ammonia, q. s., till blue litmus paper is only faintly red.

B.

Silver Nitrate	45 grammes
Distilled Water	480 ccm.

C.

Gelatine	45 grammes
Ammonium Chloride	6·5 grammes
Distilled Water	480 ccm.

D.

Silver Nitrate	46 grammes.
Distilled Water	180 ccm

C is prepared in solution as directed for the previous formula, and D is slowly added with constant agitation, then A, and finally B. The emulsion is washed as above described.

Starnes suggested the use of acetate of soda, and Henderson gave a somewhat similar formula in the *Photographic News* for 1886, p. 252.

Starnes' formula is :—

A.

Gelatine	40 grammes
Acetate of Soda	8 grammes
Distilled Water	960 ccm.

B.

Silver Nitrate	28 grammes
Distilled Water	480 ccm.

C.

Chloride of Sodium	4 grammes
Acetate of Sodium	6 grammes
Distilled Water	480 ccm.

Solutions A and B are mixed together and C. added gradually, and finally

Gelatine	160 grammes

swollen and dissolved in water are added, and the total bulk of the solution made up to 2880 ccm. This emulsion is used without washing.

Barker gave the following formula for a tartrate emulsion in the *Photographic News*, 1885, p. 174 :—

Gelatine	175 grammes
Chloride of Ammonium	18 grammes
Rochelle Salts	50 grammes
Silver Nitrate	75 grammes
Alcohol	120 grammes
Distilled Water	2·5 litres

The salts are dissolved in the water, the gelatine added, and allowed to soak for an hour or two, melted by the aid of heat, and then the silver added. The emulsion is kept at a temperature of 100° C. for ten minutes, allowed to set, and then washed once, or it may be used unwashed.

Personally we recommend the following modification of the above formula, which will be found satisfactory :—

Water	8 ounces
Silver Nitrate	¼ ounce
Rochelle Salts	20 grains
Ammonium Chloride	10 grains
Alum	50 grains
Citric Acid	1 drachm
Gelatine	1 ounce

In one of the salt jars, thoroughly clean, place the gelatine and six ounces of water. In a glass beaker put the silver, citric acid, and one ounce of water, and in another glass vessel the alum, Rochelle salts, the ammonium chloride, and another ounce of water.

When the gelatine is thoroughly soaked and swollen the jar is placed in the saucepan, which is then filled with warm water. Place the whole over a gas stove or a slow fire, and dissolve the gelatine. When this is accomplished the salt solution is added, and the whole well stirred with a glass rod. Never allow the mixture to become heated to more than 120° Fahr. Take the temperature every now and then to avoid this.

We have now to add the silver, and the emulsion is made. On the addition of the silver we form a sensitive compound, so that this operation must be carried on either by gas or a yellow light. Diffused light is too actinic, as the emulsion as a heated solution is far more sensitive than the paper coated and dried with it.

The addition of the silver is the most important operation in the making of the emulsion, and must be done carefully. Add the solution to the gelatine in very small quantities. It is a good plan to put it into a dropping bottle, and add drop by drop. During the addition of the silver the emulsion will turn to a milky-white; and it must be kept rapidly stirred the whole while, in order to prevent the silver chloride thus formed from sinking to the bottom, and to thoroughly mix the separate ingredients.

Our emulsion is now formed, and we now require to filter it. This is done by straining through a piece of fine muslin or a flannel jelly-bag into another clean salt jar ready to hand.

Whilst the emulsion is being made preparations for the coating of the paper should be arranged.

Directly the silver is added the temperature of the emulsion is raised to 120° Fahr., and then filtered at once. No cooking or washing is necessary, as with dry-plate emulsion. The emulsion, containing, as it does, an excess of silver, is easily spoilt by too much or too prolonged heating. The emulsion, when filtered, is ready for coating the paper. It can be used at once, or it can be allowed to set, and a layer of alcohol poured on the top. In this way it may be kept some little time, and be warmed up for use again at any time. The only points to be observed are that, in melting, the temperature does not exceed 120° Fahr., and that the operation of melting and allowing it to set is not repeated more than two, or at most three, times.

With all these emulsions the sensitiveness is much greater than with albumenised paper, the difference being most marked in a weak, poor light, the citro-chloride emulsion being sensitive farther towards the less refrangible rays than the complex salt of albumenised paper. Abney, in his "Instructions in Photography," gives a diagram, which shows that whereas the sensitiveness of the ordinary albumenised paper extends from the ultra-violet to beyond G to G $\frac{1}{4}$ F, the sensitiveness of the citro-chloride extends from the ultra-violet through the blue, green, and yellow to C in the orange. This sensitiveness may also be increased by digesting the emulsion for a short time, as with a bromide emulsion for negative work.

ENT OFFICE
LIBRARY

CHAPTER IV.

COATING THE PAPER.

WE will presume the reader has read the chapter devoted to the choice of paper, and has succeeded in obtaining a paper suitable for his purpose.

We have now to consider the best means of applying the gelatine emulsion to the paper in an even and perfect coating. Perhaps the simplest method is by floating it. The paper is first cut to the size required. Twenty by twenty-four inches is the usual size, but this is rather too large for the amateur to begin with, and the loss would be considerable if many sheets were spoilt. It is well, then, to cut the paper to a smaller size, calculated so that the operator can cut out a number of pieces of the size he generally uses, to avoid waste.

A flat shallow dish of a size larger than the paper to be coated should be chosen. The filtered emulsion in the salt jar is then carefully skimmed with pieces of blotting paper to remove all scum at the top. It is then carefully emptied into the dish without producing bubbles. Strips of blotting paper are drawn across the surface, and when it is quite clear a sheet of paper is laid on. This is done by holding it by two opposite corners, one in each hand. It is then curled up so that the hands meet. In this position it is made to touch the emulsion, and the hands coming apart cause the paper to lay gently upon the surface. A small corner is turned up for convenience in removing. After the paper has laid a few seconds on the emulsion one half of it is carefully raised; and if there be any bubbles or spots they are immediately touched out with a small camel-hair brush dipped in the emulsion. The paper is then lowered, and the other half treated in the same manner. This done, wait a few seconds, say twenty, and then remove the paper, allowing as much as possible of the superfluous emulsion to return to the dish without causing bubbles. The sheet should be then placed on a levelled sheet of plate glass till the emulsion has thoroughly set, when it may be hung up to dry. For floating the emulsion should be thicker than usual, about one-quarter of the water being omitted.

Another method of preparing the paper is the following. It is a little more difficult, but the advantage to be gained is that a thicker coating of the emulsion is given to the paper. Place two pieces of paper back to back, and with the finger and thumb of each hand at either corner draw it rapidly under and through the emulsion. No fear need be entertained that the emulsion will run between the sheets, as if properly done the density of the liquid presses them tightly together. By this means two sheets are prepared at once, and hung up together to dry. When they have been drawn through the emulsion bubbles will sometimes appear. The tops should then be held by the left hand only, and with the right and the camel-hair brush they are easily removed. The drying of the paper next occupies our attention.

ENT OFFICE
LIBRARY

CHAPTER V.

DRYING THE PAPER.

TO some extent the drying of the paper will effectually alter its quality. The paper should first be laid on sheets of plate glass in a cool room, and allowed to set. It should then be transferred to a room heated to about 80° Fahr. In this temperature it will quickly dry, and can be cut down ready to be stored away for use. The best plan is to cut it up into the size required, and keep it under heavy pressure packed in non-actinic paper.

By a careful examination of the paper when removed from the drying rack—or strings stretched across the room fitted with American clips will do—one can easily detect any defects in its surface. The parts should be more clearly marked with a pencil, and avoided when cutting the paper up.

When the process of coating the paper is accomplished and the drying operation is taking place the amateur should see about cleaning up everything that he has made use of. Remember that this emulsion will blacken anything it comes into contact with. When this is done the hands should be soaked for a few minutes in a strong solution of hyposulphite of soda, made by boiling water and hypo. This will effectually fix the hands, which otherwise would surely turn blue-black when exposed to the actinic rays of daylight. A better plan is to use indiarubber finger-stalls, and so avoid touching the emulsion at all.

NT OFFICE
LIBRARY

CHAPTER VI.

FAILURES.

THE principal failures that the amateur is likely to meet with in manufacturing a paper of this kind are given below.

FAILURES IN MAKING THE EMULSION.

Precipitation of the silver in a white powder at the bottom of the emulsion is caused by a too hasty addition. The remedy is to use a dropping bottle.

The emulsion turns yellow. The temperature has been allowed to become too hot, or the emulsion has been kept hot too long.

DEFECTS IN COATING THE PAPER.

Small black specks appear on the paper. Inferior paper containing bits of metal.

Thousands of minute bubbles visible. The emulsion is too hot.

The emulsion runs away from the paper in spots when held up over the emulsion. Return it to the solution for a longer space of time.

FAILURES IN DRYING.

The paper dries with a dull surface. The emulsion was too hot.

A large quantity of the emulsion runs off the paper when hung up to dry. The room is too warm.

APPENDIX.

GELATINO-CHLORIDE PRINTING-OUT PAPERS.

ARISTOTYPE.
CELEROTYPE.
OBERNETTER.

Descriptions, Particulars of Procedure, Price Lists, Testimonials, etc., supplied by the makers.

PATENT OFFICE LIBRARY

LIESEGANG'S ARISTOTYPE PAPER.

(Registered Trade Mark.)

MADE BY ED. LIESEGANG, DÜSSELDORF, GERMANY.

Aristotype Paper is claimed to give better prints than the best albumen paper. It renders all the fine details of the negative, and gives brilliant prints even from thin negatives. Its surface can afterwards be rendered matt or brilliant, according to the mode of drying adopted.

It is ready for printing and can be toned and fixed in one bath, according to instructions which are sent with it.

Extracts from Letters and Journals.

"I must frankly state that during my thirty years' experience as an amateur, I never met with anything better. With this (Aristotype) paper printing is a pleasure. The operations proceed not only much quicker than with albumen paper, but the prints have from the very first a pluck which they retain during all the stages they have to pass through. And, as Mr. Liesegang claims for his paper, weak negatives will do as well as strong ones, which, in my eyes, is a point worthy of the highest consideration. The highest results can be obtained with no more than ordinary trouble. I hope nobody will consider these lines as the puffing of a commercial article. I can certify that I do not even know the maker.

"H. J. E. HAAKMAN."

(*Year-Book of Photography*, 1887.)

"**Aristotype Paper.**—In reply to 'T. V.' I must say that I have of late experimented a great deal with this paper, and have found it exceptionally satisfactory, as I have succeeded in getting tones which were impossible with albumenised paper. Thin negatives give as good results as denser ones. I use the sodium phosphate toning bath, and can get any tone, from a rich purple to a deep black, with it. Toning is made a pleasure with this paper. Don't be too stingy with the chloride of gold, and never take your eye from the prints while toning, for they tone very fast. I tone first, and then bath in alum.

"ALFRED STIEGLITZ."

(*Amateur Photographer.*)

"**Aristotype Paper.**—I have for some time past used Aristotype paper, with such satisfaction to myself that printing on ordinary albumenised paper appears poor in comparison. It prints rather quicker, suits equally a dense or thin negative, renders detail clearer, tones quicker, and when dried on a ferrotype plate has a surface equal almost to enamel. After washing thoroughly I treat it to an alum bath for two minutes; then tone with this formula: gold chloride; 2 grs. ammonium sulphocyanide, 30 grs.; soda hyposulph., 1 gr.; water, 8 ozs. It is a strong bath, and the first prints must be rocked and watched, as it tones very quickly; afterwards the print is put into the hypo. bath (without washing)—2 ozs. to one pint. I have never had frilling. Talking of toning, my impression is, the toning bath for albumenised paper as generally recommended is too weak in gold. We are told a grain will tone a sheet of paper. I confess I have not found it so; I am rather lavish with gold, but I make it myself at a cost of a penny a grain. Still, whatever it costs, I don't think the baths generally used are strong enough.

"J. G. Braden, Surgeon."

(*Amateur Photographer.*)

Communications relating to Aristotype Paper.

M. Laoureux, who has worked much with the paper, is perfectly persuaded that it presents neither more nor less difficulties than ordinary albumenised paper; perhaps a little less, considering that the manipulations are very simple, and reduced to the use of a single bath for toning and fixing.

For mounting M. Laoureux uses the "colle Antoine."

He showed a collection of prints taken in Switzerland, and printed upon Aristotype paper. These prints were splendid and in every way perfect; they left nothing to be desired.

M. Nuel exhibited a superb collection of photographs taken in Luxemburg; they were printed upon Aristotype paper, and some of them were considered to be real standard types.—*Association Belge de Photographie.*

Liesegang Aristotype Paper.

At the regular meeting of the New York Society of Amateur Photographers, on June 12th, Dr. Ehrman gave a brief explanation of the origin of the so-called Aristotype paper. It was a great improvement over albumen silver; all of the fine details on a negative were fully brought out. About four years ago Liesegang brought out the Aristotype paper, which is simply a paper prepared with a substratum of barium and coated with a chloride of silver emulsion. This has met with much success; and as the picture is entirely on the surface, all the fine details are preserved. The details in the dense portions of a negative are readily brought out, and much better than with albumen paper. It tones quicker and easier than albumen. For black tones it must be printed deeper, and the colour of any tone must be judged by viewing the print by transmitted light. By reflected light it looks red. The toning bath usually recommended is made of sulphocyanide of ammonium and gold. The prints fix rapidly in a hypo. bath of one ounce of hypo. to twenty ounces of water, and, after fixing, the prints only need to be washed for five minutes to eliminate the hypo. The prints should be moistened before mounting, and burnished while moist, otherwise they will be liable to crack.

One gentleman remarked that he had tried some paper he had kept over a year, which he obtained from Liesegang, and found it worked very satisfactorily.

Mr. Newton remarked that, if a little nitrate of lead was added to the combined hypo. and gold-toning and fixing bath, it would probably prevent the prints from turning yellow. If half a grain of nitrate of lead is added to the hypo. bath it will bring up an undertoned print.

Some further interesting discussion took place, and specimen prints on what is termed "Aristotype" paper were passed round, which were very beautiful.—*Science of Photography at Home and Abroad*, July 1888.

"**Aristotype Paper and how to use it.**—Sir,—Seeing so many inquiries, and being asked so frequently about Aristotype paper, has induced me to write my own experience with the same, in hopes that it may by chance prove of some little use to a few beginners who have met with some of the difficulties which present themselves in the use of these papers.

"With regard to the printing, if it is intended to use the toning and fixing bath all in one, the printing must be much deeper than otherwise; but I consider this bath too extravagant, and not so much under control as either the ordinary acetate of soda or borax baths. The printing must be carried on until the detail begins to be obscured and the deepest shades begin to bronze. Of course, a great deal depends upon the negative as to the resulting tone of the print, for the deeper it is possible to print the richer black may be got in toning.

"The prints may now be stored until a convenient time, and sufficient have been printed for toning; the more the better, as it saves the gold. Any ordinary toning bath will do. I generally use—borax, 4 drachms, water, to 20 ounces, and just before use add 2 grains of gold in solution for about every twelve ½-plate prints to be toned.

"Before toning, carefully wash in five or six changes of water, avoiding water running with any force from a tap, but rather soaking for five or ten minutes in a basin in each change of water. During this time prepare the bath for toning say six of the prints; take them one at a time, and place face downwards in the toning bath, and keep moving continually by withdrawing those from the bottom and placing them on the top, examining from time to time, as they tone very quickly if the temperature is not too low. The question arises, When shall I stop? If you want the resulting print to be a rich chestnut-brown, stop when the reddish tinge has nearly disappeared, which will be seen by holding the print up to the light and looking through, or on looking down on to it the colour appears a beautiful purple; if the toning is still continued until the lighter shades threaten to turn slaty, and the dark shadows black, the finished print will be a very rich purple black. Almost any shade can be got by carefully observing the colour on removal from the toning bath. As each print is removed another takes its place, and once more gold solution added, as the process gets slower, until all are finished. I should mention that each print is put back from the toning bath into the basin of untoned prints; this is done in order to avoid having anything whatever to do with hypo. until all the toning materials are cleared away. The prints should be now soaked in a large dish of water, and then placed in saturated solution of alum for a quarter or half an hour; again well wash, and afterwards fix in hypo.—1 in 5—for about fifteen minutes (this solution of hypo. should be freshly prepared, and no ammonia or any foreign matter added). Afterwards wash in running water for some hours, so arranged that the prints are kept moving, as they would otherwise sink very quickly; and also in such a way as not to allow them to come under the stream of water, as they are far easier damaged than ordinary albumenised paper. I should have said that a second bath in alum, after about a quarter of an hour's washing, would harden the film and facilitate the removal of the finished print from the glass, or whatever it has been dried on.

"The following process of finishing should be done in the coldest possible place, and where the methylated spirit is used no great hurry is required in using the squeegee, as the spirit evaporating for a short time materially reduces the temperature, which is a great advantage.

"The most artistic finish is by squeegeeing the print on to the ground glass; but unless the glass is very good it will give the print a frosted appearance, from small surfaces of plain glass where the polish has not been ground off. The glass should be rubbed over with a solution of one part of white wax in three parts of turpentine, and with a clean piece of flannel rub again until the surface is evenly coated. The prints may now be taken straight out of the washing water and squeegeed with a roller squeegee on to the glasses thus prepared; a separate piece for each print is most convenient. If the enamelled surface is required the process is somewhat different. The glass should be of good quality (*i.e.* if glass is used), preferably plate, and free from scratches. Clean with strongest liquid ammonia to remove any trace of grease, and polish thoroughly with talc or French chalk. Now take the prints out of the washing water and soak for about ten minutes in methylated spirit, and then squeegee on to the glass as before. In using the squeegee remember to work all one way, so as to drive out all air bubbles.

"When perfectly dry, hold the glass to the fire until quite hot; the print will then begin to give way from the glass round the edges, and by inserting a piece of stiff paper and using like a spokeshave, or even a thin card, it may be removed quite easily without even a crack. Very few will be found to stick if the glass has been properly cleaned; those on the ground glass will almost drop off themselves as soon as dry, without any heat.

"The enamelled prints should be mounted with fish glue, or anything similar, by the edges only, about one-sixteenth of an inch all round; and the roller squeegee again comes in useful. The matt-surfaced prints may be done the same way, or pasted all over with starch and passed under a roller, and your print is finished. But success depends mainly upon three things, viz., patience, observation, and cleanliness; without these you will find bits of dirt on the face of your print which cannot be removed, or your print is any other colour than what you want, or you have been in too great a hurry and not properly cleaned your glass plate, and omitted some little detail which is sure to be found out when it is too late. And, as a last word of caution, let me say that the utmost care is required throughout the whole process, for it is 'one of those things that make swearing easy.' I hope that the few hints that I have mentioned will prove a help to somebody, and that some of our brother-amateurs will let us have a little more of their experience on the same and similar subjects, etc.

"Yours, etc.,

(*Amateur Photographer*). "A. J. S."

"**Aristotype Paper.**— Sir, — Your correspondent 'A. J. S.' evidently gives himself a good deal more trouble in toning aristotype prints than I do, but I doubt if he gets better results.

"My method is simplicity itself, and is as follows:— Put prints *direct* into toning solution, composed of chloride gold and sulphocyanide of ammonia only (no washing). When toned rinse in clean water, and then into fixing bath—say, 2 ounces hypo. to 1 pint water—10 to 15 minutes; wash well in several waters, then hang them across a line or cord with faces upwards. I strongly recommend this to fellow-amateurs in preference to the more complicated formulæ and directions usually given.

"Yours, etc.,

"A. W. D."

(*Amateur Photographer*).

"**Aristotype Paper.**—Sir,—Your correspondent, in writing on the subject of 'Aristotype Paper, and how to use it,' invites those who have used the process to give their experience for the benefit of your readers. Since the introduction of the Aristotype paper I have used hardly any other process, and the results which I have obtained prove this paper, in my opinion, to be one of the most suitable for the use of amateurs. Its principal advantages are that it is suitable for all classes of negatives, over-exposed and under-exposed, dense and thin; that it is a quick process and a sure one. I should recommend those who are about to give 'Aristotype' a trial to adopt the single bath—'combined toning and fixing'—method, and to buy the solutions ready mixed. The working is simple in the extreme. The print should be, before toning, considerably darker than required when finished. It is placed, without washing, into the combined bath, where it remains until the required depth of tone is gained; the print is then washed in the usual manner, and is finished. Nothing easier and nothing more simple. Should a glaze be required, and the prints are at their best when finished in this way, proceed as follows:—Leave the print, which is undergoing its final wash, in the water. Take a piece of glass, without scratches, wash it well under a tap, and polish with a clean cloth. Then dust well with French chalk, and rub with a piece of cotton wool until the powder disappears; if it does not disappear, dust it off with a cloth. Now take your print from the water, and let the superfluous water run off; place it face downwards on the glass, and through a thickness of blotting paper squeegee in the usual manner. Stand the glass on one side and leave it till *quite* dry. This is one of the causes of failure; do not attempt to move the print until there is no doubt about its being dry. With a knife lift up one edge of the print, and it will peel off; if it will not peel off it is because there is dirt on the glass, damp in the print, or the French chalk has been omitted. If these points have not been neglected the print will peel off with great ease. I never have a sticking print, although I work without great care. The most successful method of mounting the glazed prints, which will not bear handling on the surface, I learned from the directions given with a mountant; it may not be generally known. The Aristotype prints must be mounted dry; use always a paste mountant. Do not apply it to the print itself, but cover a sheet of ordinary paper well with the mountant by means of a brush. Take the print and place it as if to mount it on the paper, then squeegee, quickly, of course, over an intervening sheet of paper. Quickly peel off the print again, place on the mount, and squeegee. By this means the print is evenly coated with paste without the slightest chance of damaging the glazed surface.

"Those who are about to try the process of 'Aristotype' need not be afraid of its difficulties, as sometimes portrayed. It always makes the best of a bad negative, and is consequently the amateur's friend.

"Yours truly,
"L. L."

(*Amateur Photographer*).

MOUNTING ARISTOTYPE PRINTS.

"I should recommend the following: 1 ounce of dextrine, and ½ ounce of loaf sugar; mix into a mucilage with warm water, and stand on the hob for an hour or two till perfectly transparent. Do not use gum. "J. PAWSEY."
(*Photography*).

"A saturated solution of indiarubber in benzole is, perhaps, the best mountant for glazed Aristotype prints. The prints, of course, must be dry. For wet mounting there is nothing better than the ordinary starch mountant as used for albumenised paper. Gum is not generally considered a safe mountant, though recommended by some.
(*Photography*). "L. S. D."

"I have never yet found anything to beat fresh-made starch paste, made as follows: Take ¼ ounce starch and mix with about 7 ounces water, and gently heat to boiling point, and continue to boil for about three minutes, stirring constantly. When using for mounting don't spare the paste, but work it well into the paper, and especially so round the edges of the print. In pressing or squeegeeing on to the mount cover the print with a piece of waxed paper (such as sensitised paper is generally wrapped in), and smooth down over that. "HYDRO."
(*Photography*).

"Gum arabic of the very best quality would do to mount Aristotype prints. It should be obtained as pure as possible, dissolved in hot water, and the whole filtered through muslin.

But a better mountant to use would be: gelatine, 1 ounce; water, 4 ounces; alcohol, 6 ounces; carbolic acid solution, 1 ounce. In either case the mountant should be placed on the back of the print, a quarter of an inch from the edge all round, not all over. Place on the mount, then place a heavy weight on the picture, and let it remain for several hours. Great care must be taken not to scratch the surface of the picture. "SILVER."
(*Photography*).

"The following, suggested by Mr. G. Wharton Simpson, will be what you want:—'Take 80 grains of gelatine and swell them with the least possible quantity of water, and boil in 2 ounces of alcohol for a short time, keeping well stirred with a piece of glass rod. When cool the solution will become gelatinous. It can be used for mounting by letting it stand in warm water. With this mountant prints may be mounted on foolscap paper, and they will be as flat as if mounted on the thickest cardboard. To preserve the gloss on mounted Aristo. prints, procure some black glazed paper, white on one side, and take a piece one-sixteenth of an inch smaller all the way round than the print to be mounted, and having coated the white side with the mountant, press it on the back of the print (while it is still quite damp), which has been squeegeed to glass or vulcanite. When quite dry the print can be removed from the glass. Now paste the backing paper and mountin the usual way, putting under a weight for about an hour. Do not let any mountant get on the surface of the print.—Since writing the above I notice that the black paper mentioned is advertised by Fallowfield at 1*s.* 3*d.* per quire. He also supplies metal plates for producing a higher gloss than that given by glass.' "CAIUS MARIUS."
(*Photography*).

"Practically, the best way to mount these prints is to apply the mountant—hereafter given—to the back of the print when squeegeed, and let it dry with the print. Then damp the mount, and place on it the dry print, and use plenty of pressure to effect adhesion. The following mountant is a very reliable one, and was given in the 'British Journal Almanac' two or three years ago: Carefully pound ½ ounce of best white gum arabic to a fine powder, and mix with it three times its bulk of dextrine, add 2 ounces of water, and work into a thick, smooth paste, and when quite smooth gradually add 5 ounces more water. Pour this into a jam-pot, and place the jam-pot in a saucepan sufficiently full of water, and boil for fifteen minutes, stirring all the time. It may then be poured into a wide-mouthed bottle, and after the addition of five drops of ammonia is ready for use. A stiff brush inserted in the cork will add to its usefulness. Gum used alone is liable to crack off the mount after a time. The secret is to keep the print as dry as possible to preserve the gloss.

"G. A."

(*Photography.*)

ARISTOTYPE PAPER.

"This is a Gelatino-chloride Printing-out Paper; and, as I have been working with the paper recently, my experiences may be useful to brother-amateurs.

"The paper seems to keep well in the Indian climate. The prints I sent to the April competition were made on some samples that had been kept three months at Secunderabad.

"On receipt of the paper, it had best be kept in tin calcium tubes, similar to those used for storing platinotype paper. The paper should not be unduly exposed to light, as the whites are apt to suffer. The paper is easy to work; very beautiful tones being obtainable according to desire of operator, from red, brownish red, to violet, purple, and black. The beauty of the paper is the wealth and delicacy of the details, and the fine rendering of half tones that can be obtained. Good prints can be got from almost any class of negative by judicious printing.

"The following are the instructions for working the paper:—The printing is done in the same way as on ordinary silver paper, but it need not be carried to quite so great a depth, except very black tones are desired. The prints keep well, and may be stored many days before toning is resorted to. They should be protected from the damp. When ready for toning the prints should be washed in several changes of water till all milkiness disappears. The following toning bath I have used with success:—

Stock-solution A.

Distilled water	17 ozs.
Sulphocyanide of ammonium . .	2 "

Stock-solution B.

Distilled water	17 ozs.
Chloride of gold	38 grs.

For use take—

A solution	1¾ ozs.
B "	1¾ "
Distilled water	17 "

"This dilute solution will keep well for a long time. It should be strengthened from time to time with A and B when the prints tone too slowly.

"The wet print is now placed downwards in the toning bath, and the dish is gently rocked. Glass or porcelain dishes should be used. The print is fully toned in from two to five minutes. It should be carefully lifted up from time to time, and the progress of the toning watched. When the desired colour is reached it should be taken out of the bath, and the solution be allowed to drain off, and then, without washing, it should be transferred to a fixing bath for ten minutes, being carefully moved about from time to time. The fixing bath is made as follows:—

Hyposulphite of soda	1½	ozs.
Alum	5	drms.
Distilled or rain water	17	ozs.

"I have not found that there is much loss of tone in the fixing bath, as in an albumen print; after fixing, the prints should be washed in several changes of clean water for two hours. The tendency to curl or drying is very slight; nothing to the extent met with in albumen prints; all toning operations should be conducted in subdued light. In hot weather, to prevent the films dissolving, it is advisable to harden them after toning by soaking the prints in a weak alum bath, or in a solution of 7 drachms of alcohol in 3½ ounces of water.

"The prints can also be toned and fixed in one bath. For those who may wish to try it, I give it:—

Alum	45	grs.
Sulphocyanide of ammonium . .	2¾	drms.
Acetate of lead	1	drm.
Citric acid	45	grs.
Hyposulphite of soda	3	ozs.
Distilled water	14	,,

"Add scraps of ordinary sensitised paper (about half a sheet). Let it stand for twenty-four hours, and then filter and add one ounce of the following solution :—

Chloride of gold	45 grs.
Distilled water	21 ozs.

"This toning bath will keep well for a year, being strengthened from time to time as required. For toning, the prints are placed in this bath without washing; and when the desired tint is obtained, the prints are thoroughly washed and treated as above.

"A. G. E. N."

(*Journal of the Photographic Society of India.*)

PRICE LIST

OF

Liesegang's Aristotype Paper.

(*Registered Trade Mark.*)

		s.	d.
24 sheets	4¼ × 3¼ in.	1	6
24 ,,	Cabinet	2	6
24 ,,	6½ × 4¾ in.	3	4
24 ,,	8½ × 6½ ,, ...	6	0
24 ,,	10 × 8 ,, ...	9	0
24 ,,	12 × 10 ,, ...	13	6
24 ,,	15 × 12 ,, ...	20	0
24 ,,	21 × 19½ ,, ...	44	0

ED. LIESEGANG, DÜSSELDORF.

CELEROTYPE PAPER.

Celerotype is a name given to a most valuable addition to the gelatino-chloride printing processes. We say valuable addition because it possesses so many advantages over existing gelatino-chloride papers. First, it is manufactured in England, and this with all patriotic persons should in itself be an important consideration—in the present reign of foreign goods it is quite a treat to find something which is "made in England"—but, besides this, Celerotype undoubtedly possesses many advantages. First of all, it is more permanent than other papers of a like nature. It prints very rapidly, and gives remarkably brilliant images. Amateur photographers and professionals will find it a wonderful boon in dark days, as it is possible to obtain two prints in the time required to print one upon ordinary sensitised paper.

The paper is sold ready sensitised, and is manufactured by the Blackfriars Photographic and Sensitising Company, of Surrey Row, Blackfriars Road, S.E., and is sold in sheets and cut sizes. It has a very fine surface, and the paper is tough; much tougher than any other paper of a similar nature, and far more convenient to handle.

Regarding the working of the paper there is little to be said. The operation is a very simple one, and differs but slightly from other silver printing papers. The dark shadows should be printed to a bronze green, and the image should be somewhat darker than required for the finished picture, to allow for the usual loss in the subsequent operations.

The prints are first washed well in one water, and are then ready for toning. Almost any toning bath can be used, the tones varying with the different formulæ used, so that the operator can select for himself that bath which gives him the most pleasing results. Tastes vary so much with regard to colour that it is impossible to give a bath that would give tones to please every one. The Company recommend one of the following baths:—

Tungstate Toning Bath.

Sodium tungstate	¼ oz
Gold chloride	4 grs.
Water	20 ozs.

Acetate Toning Bath.

SOL. 1.

Sodium acetate (recrystallised) . .	¾ oz.
Gold chloride	4 grs.
Water	20 ozs.

SOL. 2.

Ammonium sulphocyanide . . .	100 grs.
Gold chloride	2 grs.
Water	8 ozs.

Keep Nos. 1 and 2 separate. For toning, take in the proportion of 20 ozs. of No. 1 to 6 ozs. of No. 2.

We would advise photographers to try these baths, and also any other bath they may prefer, but above all not to give in and condemn the paper because they do not happen to obtain the desired results the first time. This is a practice so many are guilty of. Magnificent results are to be obtained with this paper.

After toning, the prints are fixed in a solution of hyposulphite of soda—2 ozs. to 20 ozs. of water; fifteen to twenty minutes will suffice to fix. After removing from the fixing bath the prints are well washed in several changes of water; one hour will suffice, provided the water is changed often and completely. After washing, the prints are placed in a saturated solution of alum for a few minutes, and again washed.

The glass upon which the prints are to be squeegeed down should be prepared before the prints are ready to be taken from the water. The quality of glass which we believe to be best is known as polished plate, but as the surface of this glass is somewhat soft it is desirable to be careful that it should not get scratched. We know of nothing better for the preliminary cleaning than "Monkey Soap" and a little alcohol well rubbed over the glass. A fair test as to whether the glass is cleaned or not is the old one which used to be employed for ascertaining whether a plate was fit for coating in the wet collodion process. This is, to breathe on the glass, and if the breathing disappears evenly, it may be assumed that the glass is fit for use; if, on the other hand, it should show patches, the glass is not as clean as it ought to be. After this is done it is necessary to wipe the glass over with a little French chalk, using a tuft of cotton wool, and removing the chalk either with wool or an old silk handkerchief. If the glass is thoroughly cleaned there is no danger whatever of the prints sticking.

With regard to the matt-surface prints, these are obtained by squeegeeing on to ground glass, the quality of which should be somewhat similar to that used for focussing screens. No rougher glass ought to be used, as it not only spoils the appearance of the prints, but renders it difficult to get them off. With the ground glass it is advisable to use a very small quantity of olive or sweet oil, say a single drop on a plate about 17 × 12; this should be rubbed thoroughly over the surface, and well cleaned off before the print is squeegeed. Instead of glass plates, ebonite, or ferrotype plates may be used, and with them it is not necessary to be so particular in cleaning, but the results are far inferior to those obtained on glass.

We next come to the mounting of the prints. This is an operation in which many fail with gelatino-chloride papers. With Celerotype, however, the paper will be found much thicker, and consequently the mounting solution does not penetrate into the print so easily and destroy the gloss.

The Company sell a special paper which is cut a little smaller than the print, and easily pasted on to it while the pictures are attached to the glass. When dry, the print, with the paper attached to it, is removed, and can easily be mounted without the slightest loss of brilliancy. With the "Celerotype Mountant," prints can be successfully mounted either by applying the mountant all over the back or to the edges only.

From experiments it has been found that this paper is absolutely permanent in the adopted sense of the word. The reasons of this are: firstly, because the film lies on the surface of the paper, and all the soluble salts are easily removed; secondly, there is no free silver in the paper; and thirdly, the compound is a much more stable one than that extremely uncertain and variable one—albuminate of silver.

CELEROTYPE.

TESTIMONIALS.

"*Alvaston, Derby, March 18th*, 1891.

"DEAR SIRS,—I have tested the packet of **Celerotype Paper** (sent some time ago) and find it in every way **most satisfactory.** The **Emulsion** is **tough,** and stands any amount of rough usage; for **ease of working** and **beauty of results** I have not yet found its **equal** among **gelatino-chloride "print out" papers.** Faithfully yours,

"W. ETHELBERT HENRY,
"*Photographic Specialist.*"

"11, *Hornsey Rise Gardens.*

"I HAVE lately taken up your **Celerotype Paper** with far better results than I could have anticipated (without getting used to it, so to speak). I may mention that I have been at Photography over twenty-seven years and should know something of manipulation."

W. B.

"*Thurning Rectory, Oundle, October 23rd*, 1890.

"GENTLEMEN,—I have given the packet of **Celerotype** you sent me a thorough trial. I much prefer it to any other type Paper. It prints remarkably quickly, losing nothing in the final tone, which is a common occurrence with most of the Albumenised Papers. The range of tone is very broad, from a beautiful purple to that of an engraving. It was chiefly in regard to the latter that I tested it. Finished with a matt surface it is almost indistinguishable from a fine wood engraving. Mine have been produced with far less gold than you recommend. I have given the specimens away among my photo friends, who are charmed with them. If the price is not too high it ought to find a fine market. Yours faithfully,

"J. CARTER BROWNE, D.D."

The Blackfriars Photographic and Sensitising Co.,

1, SURREY ROW, BLACKFRIARS RD., LONDON, S.E.

PATENT OFFICE LIBRARY

THE OBERNETTER GELATINO-CHLORIDE EMULSION PAPER.

By J. R. GOTZ.

The Collodio-chloride Process was invented and used practically by G. Wharton Simpson as early as 1865, though the properties of silver chloride were known long before him. The process of emulsifying it with collodion was, however, not well understood. Simpson used 1½ parts calcium chloride, with 7½ parts nitrate, in 480 parts collodion; later on he recommended 1 part citric acid, and 2 parts strontium chloride, with the above 480 parts of collodion.

Many others, such as Monckhoven, Abney, Liesegang, and Haak, experimented with collodio-chloride; and numerous formulæ came out of their hands in which chlorcadmium, hydrochloric acid, chlorlithium, strontium chloride, magnesium chloride, in fact almost all the combinations of chlorine, had to do service. The different makes of the commercial papers that are in use to-day have the selection of all these, but most or all of them have citric acid, calcium chloride, strontium chloride, or sodic chloride.

The process remained, however, in the hands of a few leading experimentalists when, in 1867-8, J. B. Obernetter of Munich successfully produced the *first commercial Collodio-chloride Emulsion paper.* The process soon became popular in England as well as in Germany, and added considerably to the reputation of both G. Wharton Simpson and J. B. Obernetter. Copies on Obernetter collodio-chloride paper can still be seen in many of the old studios all over Europe, all as fresh, unfaded, and vigorous as they were on the first day, twenty-five years ago.

With the advent of gelatine this process was recast by *Obernetter*, and as early as 1885 he produced his far-famed *Gelatino-chloride Emulsion paper*, which he brought out commercially in 1886; since when it has obtained a reputation equalled by none of its numerous present competitors. *Obernetter Chloride Emulsion* paper was *not only the first* commercially and *successfully produced, both in collodion and gelatine*, but also remains the *premier of all printing materials* of the present day. It has preserved its original name and reputation, avoiding the adoption of fancy and high-sounding names, such as have been adopted by later makers.

In speaking of gelatino-chloride papers "Obernetter" may therefore be taken as the *typical paper* of *the class*; being the only one among the known papers that has preserved its technical designation of Gelatino-chloride of silver Emulsion paper, without adopting the style and title of some fancy type.

The "Obernetter Paper," as it is called all the world over, has, apart from several slight modifications by the way of improving its working qualities, been kept up to the same *high standard of excellence* with which its inventor made it, and stands now unequalled for beauty of results, permanency, and delicacy of image amongst its competitors. There is *but one quality*: "*the best*,"—but there are several modifications and variations, every one of which is best suited to a particular kind of work.

The original paper was intended for the then general collodion negatives, and has, accordingly, been modified with the advent of gelatine by being thinned down somewhat. The original paper is still sold as the emulsion paper.

Four varieties of paper are now in the market :—

1. *The Obernetter Emulsion paper.*—For landscape work and portraiture in winter, when negatives are likely to be thin. Great depth, brilliancy of image, beautiful half tones, and remarkable rendering of the finest detail are its characteristics.

2. *The "Portrait" Emulsion paper* is a slightly modified form of the previous, suitable specially for portraiture from medium dense negatives; printing with softer gradation of half tones, but otherwise with the same excellent qualities.

3. *The "Brilliant" Paper.* Glossy surface, thin paper.

4. *The matt-surface emulsion paper* (*chlorotype*) is the latest modification. The finished surface of this paper is of a "half matt" or "dead matt" character, according to treatment. The paper is suitable for fairly dense negatives, with full gradation. The quality of prints is *superior to any other method with a matt surface*, the detail not being lost as it is in them; and from the fact that the image is held, as it were, in a transparent medium, the gelatine does not sink into the paper.

These papers allow a latitude in the character of negatives, and a range as to results of tone and depth of image, that is not reached by any other material; and the delicacy with which they render all the details of the finest negative, the beauty and depth of its shadows, and the whiteness and clearness of the high lights, have gained for them the position which they now hold. It must, however, be remarked that *gelatino-chloride printing and toning require greater care and attention than the same operation with albumen, and failures often arise through operators being unable to break off contracted habits.*

The surface is more delicate in the same degree that the image is finer. The preliminary washing must be attended to with care, and air bubbles forming on the front and back of prints must be carefully removed. More than three or four (at most six) prints should not be put into one bath at a time.

Tone must be judged by transmitted and not by reflected light. Prints may, as a rule, be considered toned as soon as all red colour has disappeared when looked through; from that point toning may be carried on or stopped according to taste. The finishing operations again appeal to the good taste of the operator or amateur.

Squeegeeing the prints down is largely practised. In most cases polished plates of glass are used, but many prefer to use ground glass: a mode which may be recommended is to clean the ground plates perfectly and then rub them in lightly with powdered talc, but so that none of it lays about loose; the print is then laid on it, face downwards, squeegeed by a roller, and left to dry spontaneously. The result, provided the print be otherwise a good one, is most beautiful, and both the ordinary glossy emulsion, as well as the matt-surface paper, gain considerably by this mode of treatment. Prints on *Obernetter paper* finished in this way are now by no means uncommon.

Without wishing to make out, as some do, that the artistic merit of a photograph lies in the way it is finished, or mounted, I prefer, on artistic grounds also, a matt to a shining surface, though I do not hold that a paper or a printing material canbe artistic or the contrary; the art must always be in the mind of the amateur or operator, but he may choose and treat his material and his subject with artistic taste, or spoil their best capabilities by the contrary treatment. Obernetter paper, happily, seldom falls a victim to this sort of ill-treatment; it is usually to be found in the hands of the best men, who know the qualities of their material and treat it becomingly.

It remains now to enumerate a number of toning baths which have from time to time been suggested and tried, and by means of which various tones are supposed to be secured. The chief ingredient next the gold chloride is sulphocyanide of ammonium; this enters into the image, and gives richness and depth to it, and should always be employed in conjunction with gold chloride.

Obernetter's original formula was—

1,000 ccm.	Water (distilled pref.) .	36 ozs.
20 grammes	Sulphocyanide of ammon.	5 drms.
1 gramme	Hyposulph. soda . .	15 grs.

To this is added—

1 gramme	Gold chloride . . .	15 grs.

dissolved in 100 ccm. water 3 ozs.

For toning, take 100 parts of No. 1 suphocyan. sol., and about 8 parts of gold solution, pouring the latter into the former and stirring up. Before toning wash out prints, free them from air bubbles, tone until the prints appear blue in the water—they will then look brown by transmitted light: when the desired tone is reached, fix in a 10 per cent. solution of hypo. Various other toning baths have been used for the purpose of varying the tones; the proportion, however, of the sulphocyanide and gold chloride to the quantity of water, remains practically the same.

Mr. W. B. Bolton, in the *British Journal of Photography*, gives the preference to—

12	drachms	Phosphate of soda . .	in 30 ozs. water
10	„	Sulphocyanide of ammon. .	„ 30 ozs. „

Dissolve the phosphate hot and let it cool; take 16 ozs. of each solution, mix, and add about 1 oz. of a 1 per cent. solution of gold chloride. This gives rather black tones. The next bath gives brown tones, and is for that reason liked by many:—

In 20 ozs. distilled water dissolve 1 oz. acetate soda
In 6 ozs. „ „ „ 1 drachm sulphocyanide of ammonia
Add 1 oz. of a 1 per cent. gold solution.

The two first are mixed the evening before use, gold is added then or a few hours before toning.

Later experiments have put several toning agents into our hands with which various tones can be obtained; amongst others a toning and fixing bath constituted as follows:—

35	grammes	Hyposulphite soda . .	say	9 ozs.
9	„	Sodium chloride (salt) .	„	2¼ „
4	„	Powdered alum . .	„	1 oz.
2	„	Sulphocyanide of ammon. .	„	½ „
50	grammes			

These are pounded up (better separately) and mixed, and left to ripen for about twenty-four hours (or better, forty-eight), then dissolved in four times their bulk of water. The bath, milky at first, will soon become clear, and is then decanted, filtered, and is used; gold being added before toning in the proportion of 10 ccm. (or 2½ drachms per 30 to 35 ozs. of bath) of a 1 per cent. solution. Alum may be added, for the above quantity about ½ oz. of saturated solution; this is specially useful when the bath seems sluggish. Should the bath become too concentrated through evaporation, add sufficient water to make up its original quantity,—print slightly deeper than finished print is to be.

The best toning for this paper is undoubtedly a bath made and sold in a concentrated form. Its composition is as follows: Chloride of ammonium, sulphocyanide of potassium, in equal proportions, in a solution of gold chloride 1 per cent. strong; these ingredients are heated and mixed at a temperature which ensures their perfect combination in the above concentrated form. The bath is intended for the "Obernetter" and "Portrait" papers; it is called A. Another similar solution, named B, is made up similarly with chloride of strontium, instead of chloride of ammonium. The two combined are used advantageously for the *new matt paper* (*chlorotype*).

The writer has lately made and used this bath generally, and has varied it with the addition of water through which a small quantity of calcium powder has been precipitated—about one drachm to a quart.

This water, previously prepared and left to stand twenty-four hours, then decanted and filtered, is used to dilute the concentrated bath in the proportion of twenty to one, and the result well repays the trouble of making it. The same is the case with the first bath—sulphocyanide alum—where the water treated with the calcium powder receives the proportionate quantity of the sulphocyanide and gold with as nearly as good a result.

I have yet to note another bath which I owe to General F. Dawson, of Cheltenham. He dissolves 3 drachms sulphocyanide in 20 ounces of water, distilled preferred;

about 6 grains carbonate of ammonia are then dissolved in 1 drachm of water, and mixed with 6 grains chloride of gold; or the *gold solution* may be used, sufficient to hold 6 grains gold chloride (about 1 ounce of a 1 per cent. solution). The ammonium carbonate is put into this, a red precipitate of gold is formed, and when the ammonium carbonate is dissolved the gold is poured into the sulphocyanide bath, where, after forming a red precipitate, it should at once dissolve and leave the bath water-clear. One ounce of alum saturated solution may then be added, the bath left to stand for twenty-four hours, and then used. If made with hot water it may be used as soon as cold.

The bath may be strengthened by the addition of twenty grains sulphocyanide of ammonia with one grain of gold: always dissolve the proper quantity of ammonium carbonate and gold together. The carbonate of ammonium is to keep the bath alkaline; test accordingly, if in doubt.

PLATINUM TONING.

Toning with platinum is yet an unexplored region, little real experience being yet at hand, while platinum is considerably less reducible than gold.

Fine sepia tones may be obtained by using—

1.	1 gramme Chloro-platinite of potass. (15 grains) in 30 ccm. of distilled water	1 oz.
2.	90 grammes Neutral oxalate potass.	2 ozs.
	45 ,, Phosphate of potass.	12 drs.
	1 litre Distilled water.	40 ozs.

For toning, take 2 parts potassium solution, dilute with 1½ parts distilled water and 1 part platinum solution.

Toning takes three to four minutes in summer and eight to ten in winter. Prints should be laid face upwards into the bath, and judged by their appearance in transmitted light,—they will appear blue in the bath. Toning should be preceded by a good wash in distilled water. After toning they must at once be thoroughly washed in cold water, or water made slightly alkaline, and then fixed in hypo. (10 per cent. strength); final washing should not last less than two hours.

Having now given full instructions for the treatment of the paper, it remains to give a few hints as to what the paper is capable of producing, and what should consequently be aimed at.

Gelatino-chloride printing and toning requires greater care and attention than the same operations with albumen. The paper lends itself to artistic production better than any other; not artistic in the sense that it is a material with which to imitate the etchings or engravings that are held up by some would-be artists as our pattern, but by that capacity for rendering all the beauty of half tone, light, and shadow of a well-lighted and correctly developed negative; the art begins there, and ends with knowing exactly how to print, tone, and mount a photograph in harmony with the nature of the subject.

Some images strike us through the fine detail, and some through the beautiful balance of light and shadow, or of their delineation. The proper treatment from beginning to end in all the operations, until the finished print is ready for mounting, constitutes the art which we cultivate. Obernetter paper is capable of rendering the highest conception of it if treated properly, as hardly any other material is able to do; but perfect pictures are only obtained from good negatives, and only in the hands of an attentive printer, desirous of seeing in every print all the beauty, detail, and gradation which are the charm of a fine negative; and then will he find in the material bearing the impression of his art the response looked for. This will specially be the case with the "Obernetter," and in a greater degree still with the new matt-surface paper.

One more hint may here be given. Should at any time the chlorotype matt paper show a tendency to redness in the high lights, add one drop of acetic acid (pure) to the washing, previous to toning, but it is advisable to pass prints into a further pure water bath before toning.

It may also be useful to mention that, in order to preserve a perfect matt surface when mounting prints, or the gloss of an enamelled one, it is advisable to back the prints while they are drying on the plate. A special waterproof paper is used and sold, which will prevent the moisture of paste, or starch, striking through; special mountants are numerous, but all are more or less penetrating, so that the application of the waterproof paper is almost a necessity.

The popularity of the Obernetter paper makes it procurable everywhere, though all information is at all times readily given by the writer.

12-5-93

OBERNETTER

GELATINO-CHLORIDE

EMULSION PAPER

Is sold everywhere throughout the United Kingdom, and can be had in the Sheet or cut to all current sizes :—

¼-plate, ½-plate, 7½ × 5, $\frac{1}{1}$-plate, 10 × 8, etc., or by the Quire at 32*s.*

OBERNETTER PAPER

will **keep** good for months, and has been kept for years uncontaminated—dry atmosphere being the only condition.

Do not accept the substitution of any other make of Chloride as the "Same Thing."

GELO.-CHLORIDE OPALS

PRINTING-OUT (SAME AS THE PAPER), OR

Gelo.-Chloride Transparencies.

Prices and all particulars and information obtained from

J. R. GOTZ,

19, BUCKINGHAM ST., STRAND, LONDON, W.C.

PHOTOGRAPHIC PUBLICATIONS NOW READY.

The Amateur Photographer. Edited by CHARLES W. HASTINGS. It is the most popular and largely circulated of any photographic paper in the world. Every Friday. Price 2*d.*

Photographic Reporter. A high-class illustrated monthly, devoted to the advancement of Photography. A special feature of this publication is the prominence given to the work of Photographic Societies. Each issue contains a Woodburytype Frontispiece, and an illustrated review of the Monthly Photographic Competitions. Price 1*s.*

The Photographic Quarterly. Edited by CHARLES W. HASTINGS. Illustrated. The only publication devoted exclusively to original articles on Photography, and the kindred Arts and Sciences, by the best writers. Each number contains a summary of the principal events connected with the advance of the Science of Photography and its progress as an Art, and will form a complete digest of all matters of interest to workers in Photography. Royal 8vo, 108 pp., price 2*s.*

Amateur Photographer's Annual. The only Year-Book brought out to meet the special wants of Amateur Photographers. Illustrated. Price 1*s.*, or, in cloth, 1*s.* 6*d.*

Amateur Photographer Prize Pictures. Containing Woodburytype reproductions of Prize Photographs sent in for competition to the *Amateur Photographer.* With descriptive letterpress and an essay. Large 4to. Price 2*s.* 6*d.* In cloth portfolio, price 3*s.* 6*d.*

Dictionary of Photography for the Amateur and Professional Photographer. By E. J. WALL. Second edition, revised, with upwards of 380 concise and explanatory articles, illustrated by many specially prepared Diagrams. Crown 8vo, cloth, 300 pages. Price 2*s.* 6*d.*

Picture-Making by Photography. By H. P. ROBINSON. Second Edition, revised, with additional chapters on Instantaneous Photography and the Persistence of Vision, and Naturalistic Photography. Crown 8vo, cloth, 160 pages. Price 2*s.* 6*d.*

The Book of the Lantern. By T. C. HEPWORTH, F.C.S. A practical Guide to the Working of the Optical (or Magic) Lantern—either as an Educational Instrument, for Exhibition Purposes, or as an Enlarging Apparatus for Photographers. With full and precise Directions for Making and Colouring Lantern Pictures. Price 3*s.* 6*d.*

The Gelatino-Chloride of Silver Printing-out Process, including directions for the production of Sensitive Paper. By W. E. WOODBURY. Crown 8vo, cloth, Price 2*s.*

⁂ *All the above, with the exception of the "Amateur Photographer," are sent post free.*

London: HAZELL, WATSON, & VINEY, Ld., 1, Creed Lane, E.C.

PHOTOGRAPHIC PUBLICATIONS NOW READY.

One Hundred Photographic Formulæ. The indispensable companion to the Laboratory. By W. INGLIS ROGERS. Price 6d.

Dibdin's Automatic Exposure Table. A Time-saving novelty in Exposure Tables. Price 1s., or in Case 1*s*. 3*d*. (In the Press.)

Amateur Photographer's Library.

Crown Octavo, Stiff Paper Covers, 1s. Limp Cloth, 1s. 3

The following form the first of a series of works to be published at intervals as the "Amateur Photographer's Library":—

No. 1. Platinum Toning. By LYONEL CLARK. This book contains full working instructions how to use Clark's Toning Process, and much very valuable information on the sensitising of every kind of paper and vehicle, with directions for printing and toning in many colours.

No. 2. Competitive Papers on Photography, 1 to 6. This volume contains seventeen prize papers upon "Cameras," "Lenses," "Shutters," "The Sensitive Medium," "Development," and "Exposure." The articles are illustrated with diagrams, and afford much valuable information.

No. 3. Experimental Photography. By C. J. LEAPER, F.C.S. The success which appertained to the publication of a series of Articles from the pen of Mr. Leaper, in the *Amateur Photographer*, has resulted in their being printed for the "Library" Series. Photography is exhaustively treated from a practical point of view, and valuable experimental research is described.

No. 4. Short Chapters on Art Photography. By H. P. ROBINSON. This handbook by Mr. Robinson is profusely illustrated, and is written in well-chosen language, clearly demonstrating the art side of Photography. The study of these short chapters can but lead to an advance in the knowledge of Photography as an art.

No. 5. Development. By LYONEL CLARK. Another very useful little work by Mr. Clark, treating of Development in a masterly manner. This number of the "Library" Series must prove a text-book for every worker in Photography, whether old or young. All the details of Development are discussed and most explicitly explained.

No. 6. The Art of Retouching. By J. HUBERT. A knowledge of Retouching is really necessary, and Mr. Hubert has been prevailed upon to write a special book of instructions, illustrated by examples, for the "Library" Series. His long experience as a professional retoucher qualifies him to undertake the task with a certainty of imparting most valuable and practical instruction.

London: HAZELL, WATSON, & VINEY, Ld., 1, Creed Lane, E.C.

2847 016
4

FINE ARTS LIBRARY
3 2044 047 577 53

NO AVE LIBRAR